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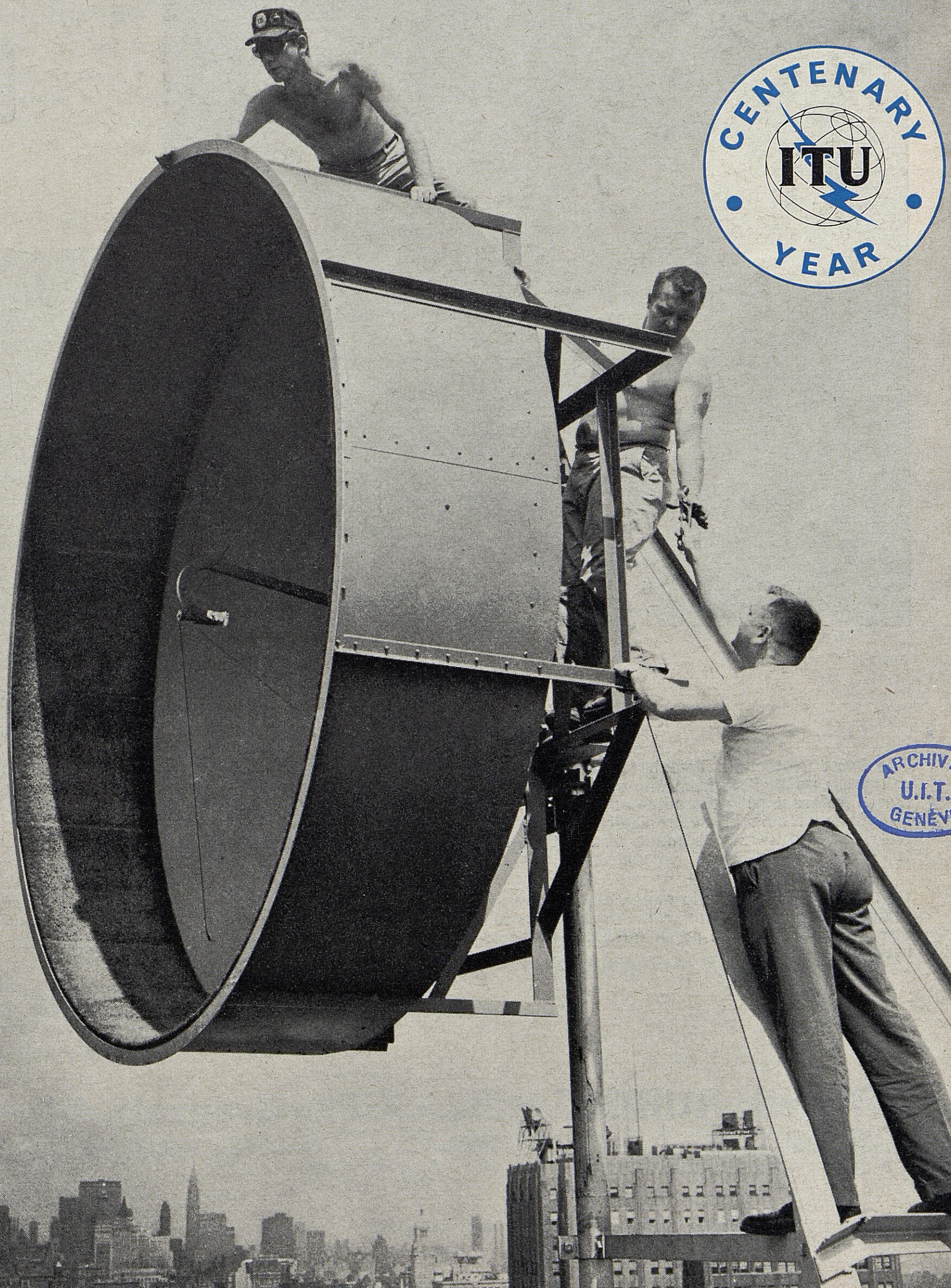
telecommunication journal

MONTHLY MAGAZINE OF THE INTERNATIONAL TELECOMMUNICATION UNION — 15 MARCH 1965



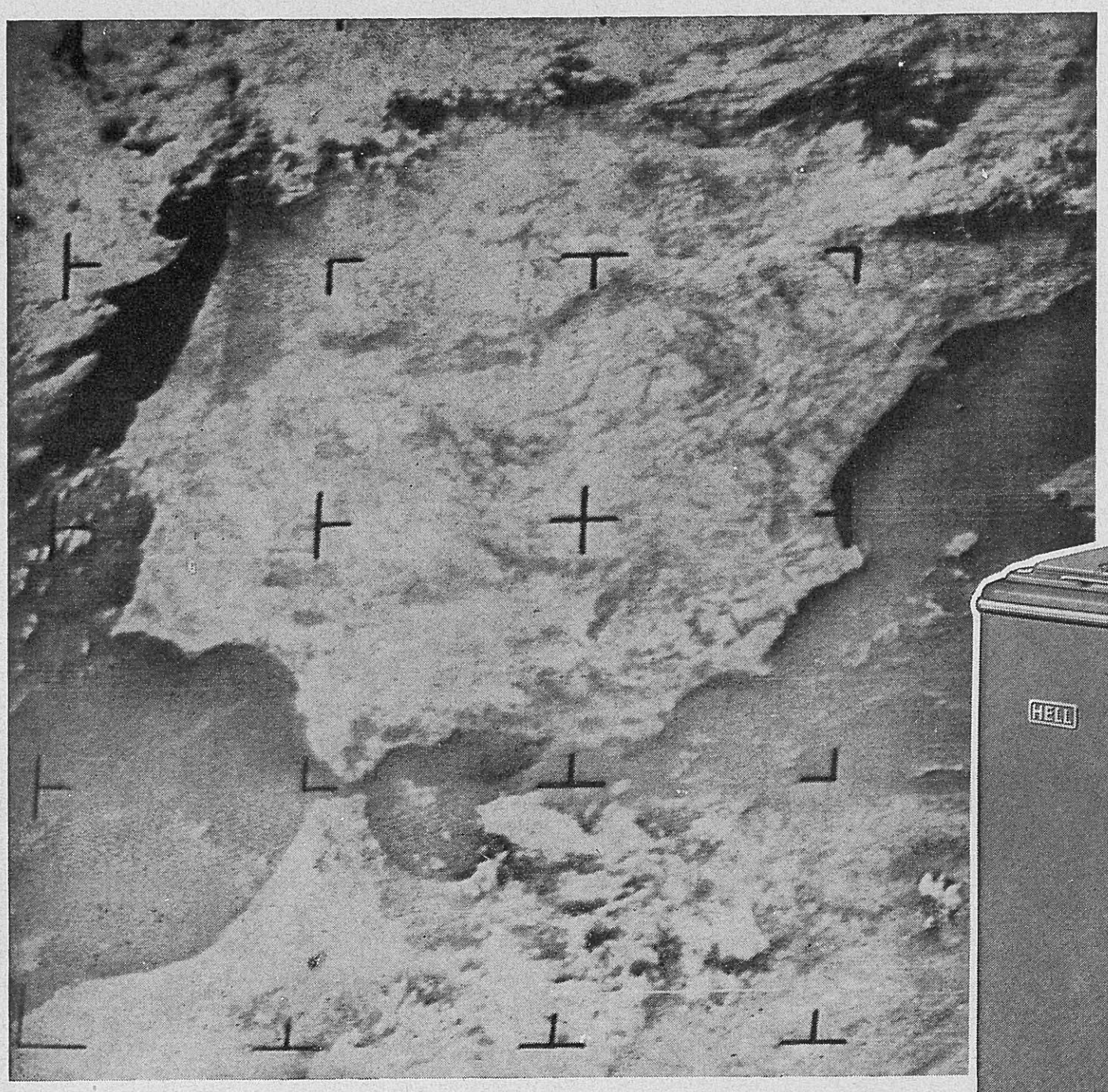
CENTENARY YEAR

ITU

ARCHIVES U.I.T. GENÈVE

HELL Automatic Telephoto Receiver TM 831

for recording satellite photos (APT-Programme)



HELL

The HELL Automatic Telephoto Receiver Type TM 831 records cloud photographs which are transmitted from weather satellites and received with suitable radio installations. Before leaving the automatic receiver, the photographs are developed and dried by means of built in electronically controlled equipment. Recordings take place at 240 r.p.m. and have a definition of about 5 lines/mm. The size of the photograph is 160 × 160 mm.

When using photographic paper, cloud pictures are recorded which permit a precise evaluation as the variation from intense black to brilliant white is stepless. Thus, tonal errors originating from paper structure and non-photographic recording systems, are avoided.

DR.-ING. RUDOLF HELL • KIEL • Grenzstr. 1-5 Federal Republic
TELEPHONE : 2011 TELEX : 0292858 CABLES : HELLGERAETE **of Germany**

Journal télégraphique (1869-1933)
57 volumes published

Telecommunication Journal (since 1934)
Volume 32

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telecommunication journal

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editorial

THE PLAN

The ITU recently published a book containing an outline for the first world-wide plan of telecommunication routes. This event calls for a few remarks on recent progress in our work of planning.

Not so long ago, plans for international routes could be prepared only piece by piece, often merely through bilateral agreements between the countries concerned. But now, when submarine cables are widely used for intercontinental links, and with the prospect of using satellites in the near future, countries can no longer act without co-ordination. The need to-day is for a single, well-knit, world network, suitable for the automatic operation of the future, and covering all international routes.

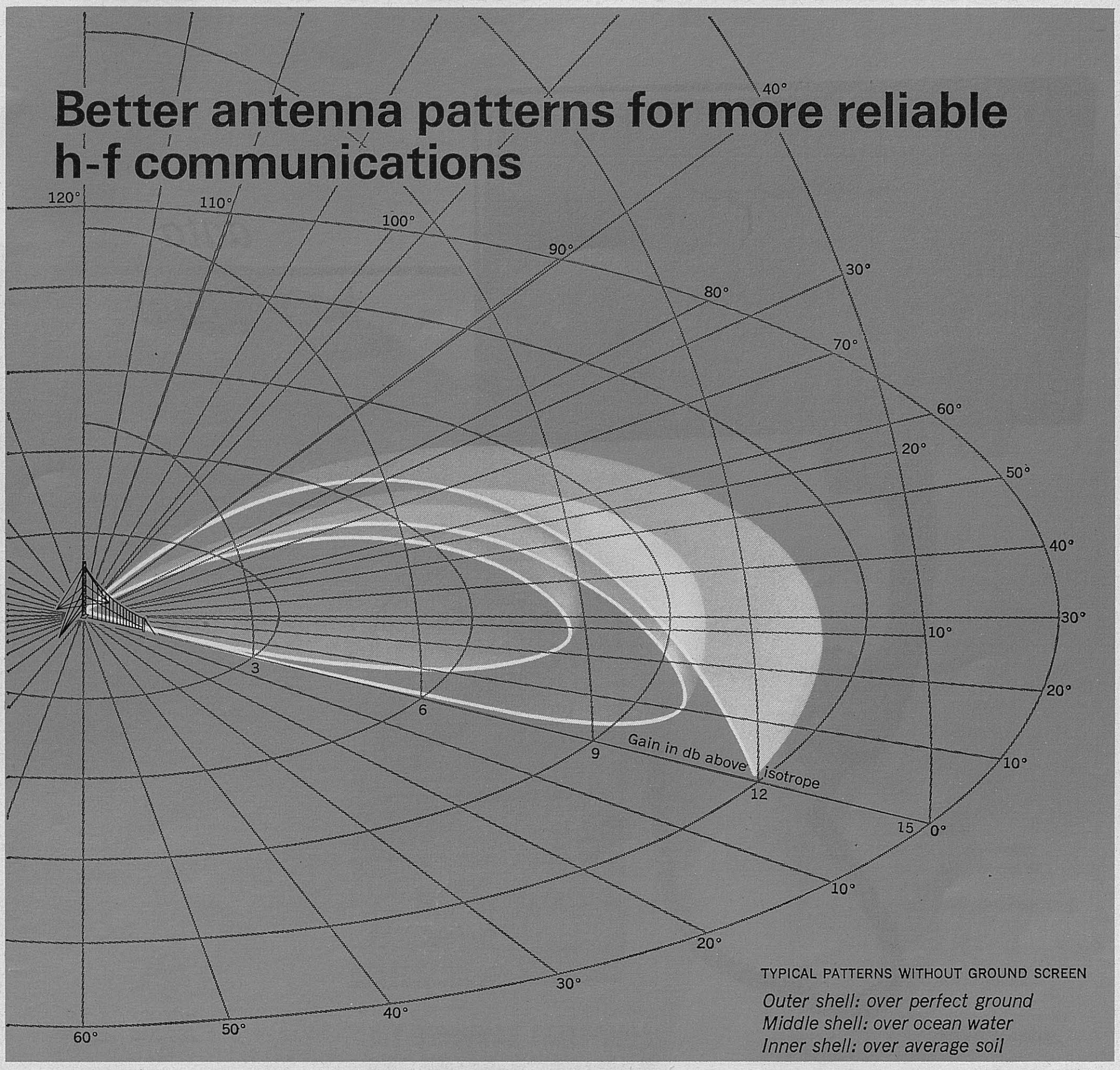
The Plan Committees, the aims of which are becoming much more ambitious, have to co-ordinate the studies carried out at regional level. They are also involved more closely than ever before in the work of the Consultative Committees, which are responsible for drawing up the standards governing the structure of the world network.

Implementation of the Plan does, of course, pose technical problems for individual countries and especially for the developing countries. The Plan Committees are examining these problems in close consultation with the CCI study groups, and are thus creating a form of technical assistance which, while it does not involve any material aid, is nevertheless of great didactic value.

In 1965, International Co-operation Year, the field of telecommunication planning is one in which international solidarity is most clearly revealed. This solidarity will bring its full reward if the physical links which the ITU is helping to establish between the countries of the world are finally reinforced by ties of friendship and fraternity.

JEAN ROUVIÈRE

Better antenna patterns for more reliable h-f communications

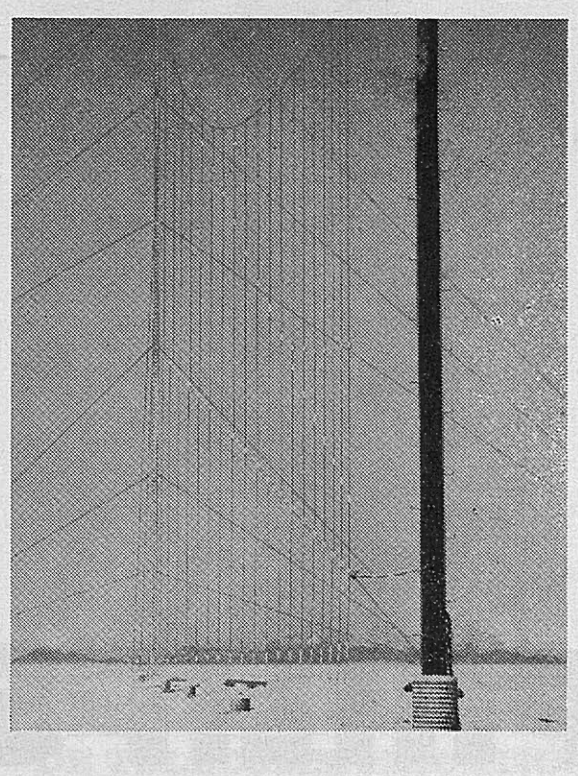


Model 747V, Granger Associates' newest and best long-haul h-f antenna, combines superior radiation patterns with a 3 to 32 Mc bandwidth, low VSWR, and minimal land requirements. It radiates all frequencies from 3 to 32 Mc at the low elevation angles required for long-distance transmission. For receiving applications, it minimizes interference and raises signal-to-noise ratio by very low side and back lobes—at least 14 db below maximum gain. Unlike many h-f antennas, the pattern does not vary greatly with frequency, and the vertical beamwidth is sufficiently broad to encompass all elevation angles required for transmission via differing ionosphere heights and propagation modes.

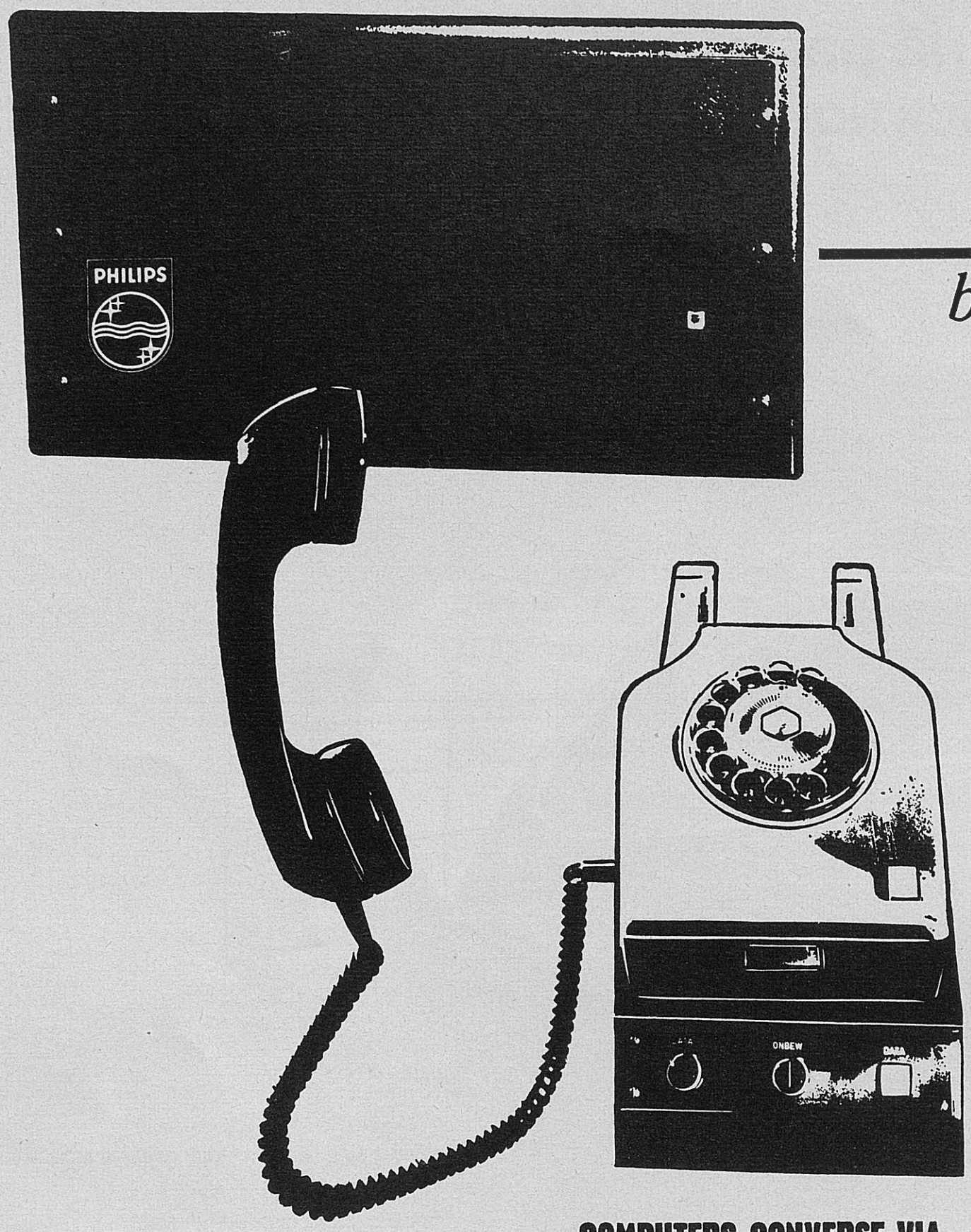
Consisting of a log-periodic curtain of vertical dipoles, Model 747V is operable without a ground screen and occupies so little land it may be erected almost anywhere. It's delivered largely preassembled to simplify installation, and optional radiator tie-down methods permit easy erection over various terrains. It stands up to 120 m.p.h. winds and the attacks of such highly-corrosive agents as salt spray.

Transmitting antennas are available with 50-ohm coaxial inputs or 600-ohm balanced terminals, capable of handling 20 kw average power (40 kw PEP) with a low VSWR from 3 to 32 Mc. Send for complete specifications on Model 747V.

Granger Associates



Granger Associates / 1601 California Avenue, Palo Alto, Calif. • Granger Associates Ltd. / Ruo House, Broom Way, Weybridge, Surrey, England



data

by telephone

COMPUTERS CONVERSE VIA PHILIPS DIGITPHONE

"Conversation" between computers and other data processing equipment is a growing necessity in modern business operation. Until recently, expensive special communication channels were required to transmit this digital information. Philips Digitphone, however, makes possible the transmission of data in digital form via normal telephone circuits: The only equipment required at each end is the Digitphone unit, a standard telephone set, and the control console, which can be placed under the telephone. Exchange of data between the two terminals can proceed under supervision of the operator or can be controlled by the Digitphone.
A connection is set up as a normal telephone call: by dialling the required number. Before and between data transmissions the telephone can be used for conversation between the operators. Upon completion of data exchange the Digitphone and the line are free for further telephone or data traffic. The equipment, despite its small size, satisfies official CCITT recommendations. So if your data-processing involves communication problems, consult Philips about this new aid to telecommunication.

PHILIPS

1856 E

N.V. PHILIPS' TELECOMMUNICATIE INDUSTRIE-HILVERSUM-THE NETHERLANDS

NUCLEAR ENERGY, TELECOMMUNICATIONS, ELECTRONICS

Alcatel

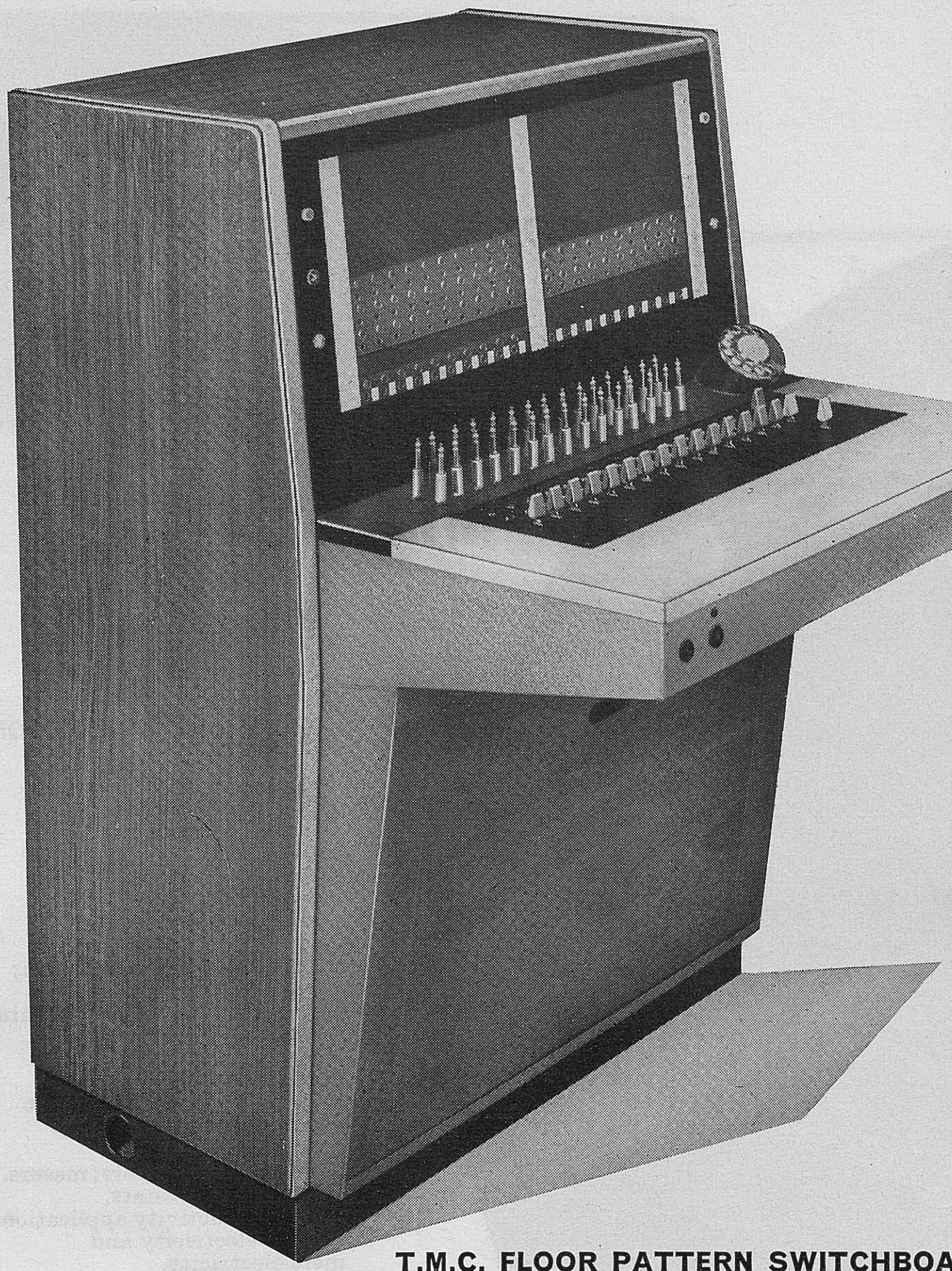
RESEARCH AND PRODUCTION

- telecommunications : telephony and radio broadcasting.
- sonars, radars, computers.
- remote transmission data-processing equipment.
- complex process automation; servomechanisms.
- digital machine-tool positioning.
- control-drive and loading-unloading of nuclear reactors.
- space navigation equipment and systems.
- quantum electronics parametric amplifiers; masers.
- cryogenics, cryostats, super-conductivity applications.
- thermo-electricity and piezo-electricity.
- «otecna» nuclear instrumentation and measuring equipment.
- pumps, valves, çircuits and vacuum gages («saema» system) «enervide» thermal applications of electronic bombardment.

Alcatel

SOCIÉTÉ ALSACIENNE DE CONSTRUCTIONS ATOMIQUES, DE TÉLÉCOMMUNICATIONS ET D'ÉLECTRONIQUE
69 RUE DE MONCEAU, PARIS 8e
FRANCE (tél. LAB 60-50)

Impact



LOW LINE STYLING

CHOICE OF EXTERNAL FINISHES

RETRACTABLE KEYSHELF

HIGHLY VERSATILE

CAPACITY UP TO 200 LINES

T.M.C. FLOOR PATTERN SWITCHBOARD

"A thing of beauty . . . . . "

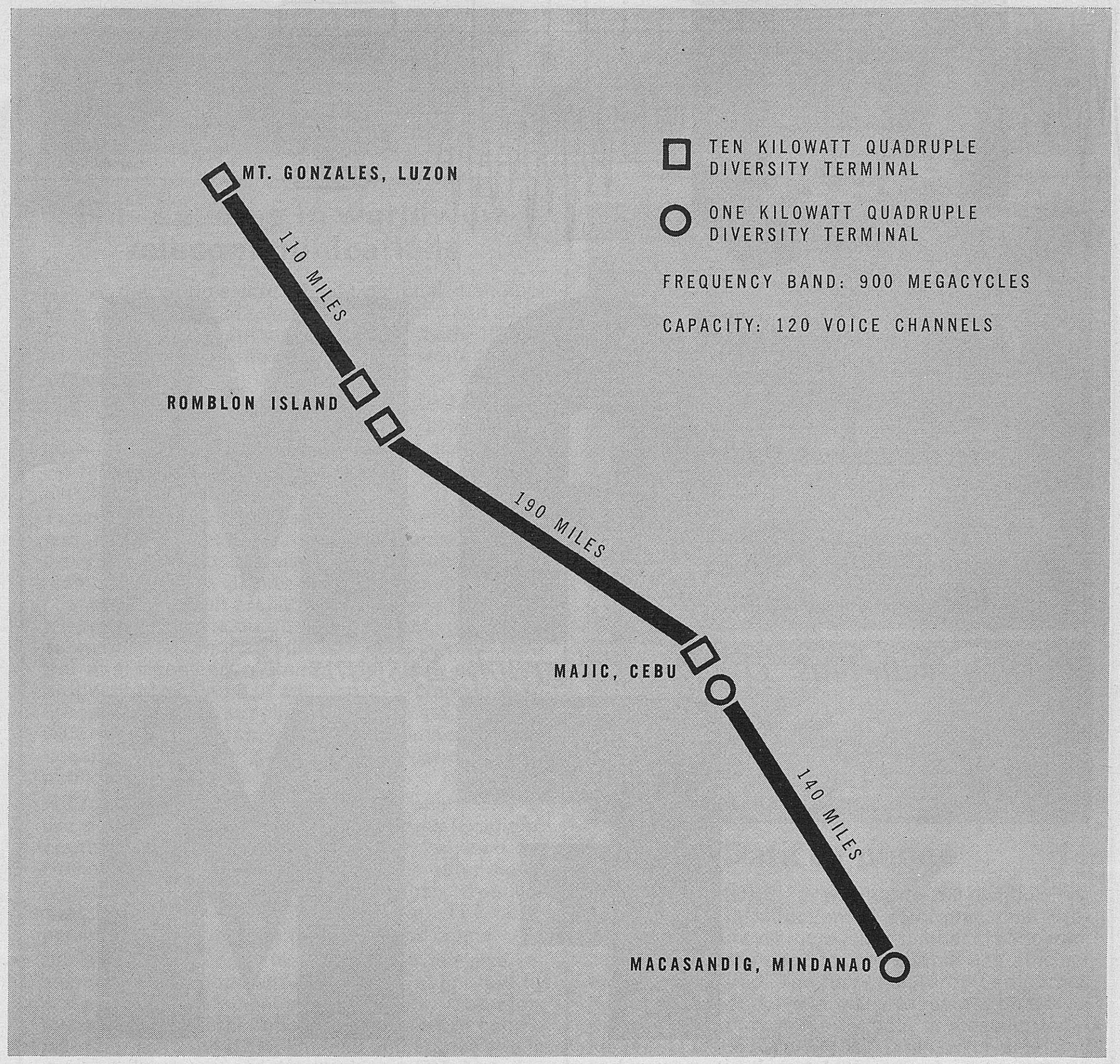
Leading industrial designers, top circuit engineers, and a production team with years of accumulated switchboard experience have worked together to evolve this superb TMC switchboard. The result is a product which in appearance and performance will fulfil the needs of many years to come. It will blend with the decor of the most modern office or reception hall. It is highly adaptable and can be variously equipped, as a multiple or non-multiple. This switchboard will serve subscribers, operators and engineers throughout a long working life—and serve them well.

TMC

TELEPHONE MANUFACTURING COMPANY LIMITED

Telephone Equipment Division • Public Equipment Unit • Martell Road
West Dulwich • London • S.E.21 • Telephone GIPsy Hill 2211 • Telex 28115

A MEMBER OF THE PE GROUP OF COMPANIES



Tropo...in the Philippines

The Republic of the Philippines joins the growing list of nations profitably utilizing REL tropo scatter radio relay equipment.

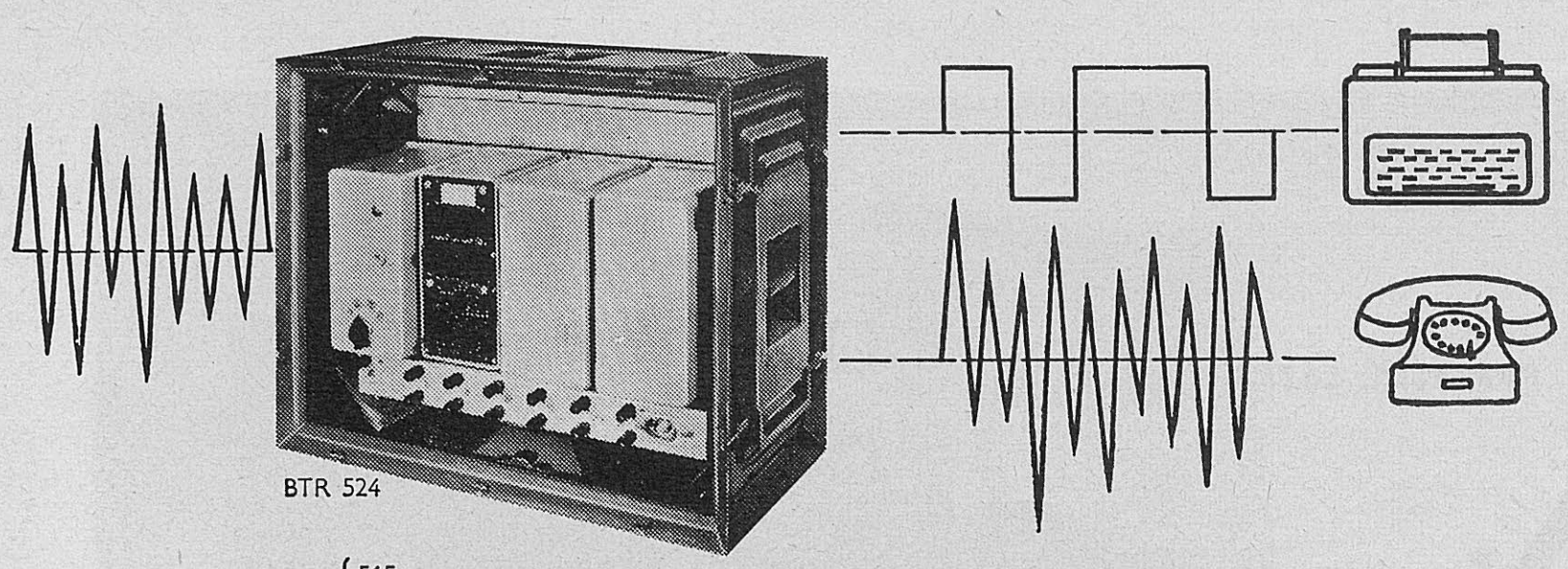
In the Philippines, a new three-span tropo scatter system provides commercial telephone and telegraph communications linking the Islands of Luzon, Romblon, Cebu, and Mindanao.

Operated by the Philippines Telephone Company, the system uses REL's internationally-proven 2500 Series equipment. This equipment is designed for an ultimate capacity of 252 voice channels, and meets or exceeds CCIR standards.

REL is the only company devoted principally to the design, development, and production of radio relay equipment for tropo scatter and microwave systems. Today, communications systems in over 20 nations are utilizing REL equipment.

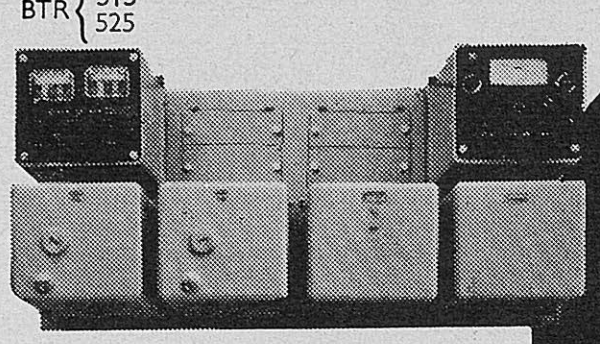
Full technical details available on request.

RADIO ENGINEERING LABORATORIES
Division of Dynamics Corporation of America
Long Island City 1, New York

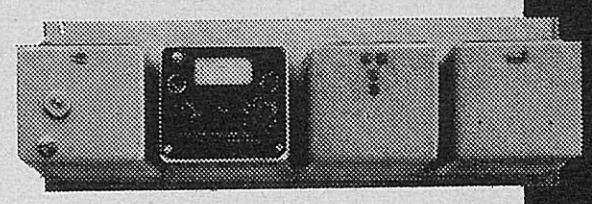


BTR 524

BTR { 515 / 525



BTR 526



FM

Speech plus Duplex Telegraph Systems

FM

Philips speech-plus-duplex telegraph equipment permits full utilisation of any 2 or 4 wire speech circuit by providing one or more reliable fully transistorized duplex telegraph channels in addition to the speech channel.

4-wire circuits

- **BTR 515** one or two AM telegraph channels above the speech band.
- **BTR 525** one or two FM telegraph channels above the speech band.

By-pass filters and branching amplifiers are also available.

2-wire circuits

- **BTR 524** one FM telegraph channel in the middle of the speech band. Telephone VF signalling and ringing included. Half and full duplex teleprinter loops.
- **BTR 526** Simplified version of BTR 524.

N.V. Philips' Telecommunicatie Industrie Hilversum, The Netherlands.

PHILIPS

PHILIPS FOR TELEGRAPHY EQUIPMENT

developed for the future, available now

an advertisement from Philips KEY CAPITALS series.

ITT TELECOMMUNICATIONS REVIEW

No. 8 MARCH 1965

ITT–Leading in worldwide telecommunications

ITT is the world's largest international manufacturer and supplier of telecommunications and allied electronic equipment and services. With 180,000 employees in 51 countries, ITT is the world's tenth largest private industrial employer.

ITT's position as the leading accredited supplier of telecommunication equipment to every major government in Europe was established shortly after the invention of the telephone in 1875 and has been maintained ever since.

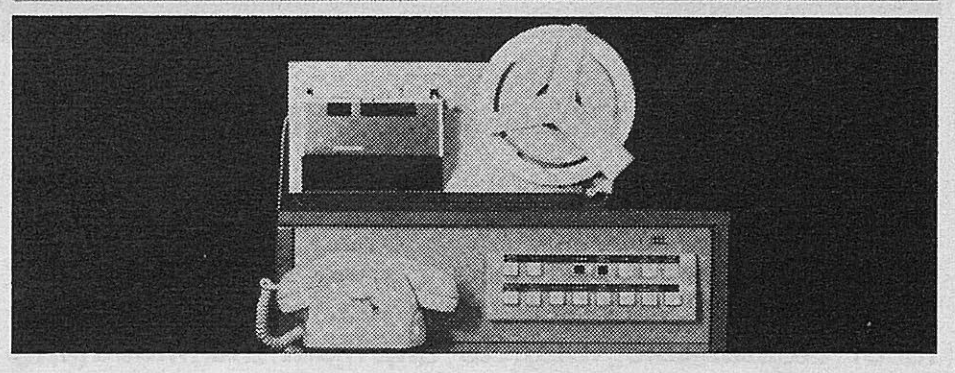
Today, ITT companies supply the European telephone market with a range of products covering every aspect of modern telecommunications. Among them: public and private automatic telephone exchanges, telegraph exchanges, telephone handsets, teleprinters, transmission equipment, complete submarine telephone cable systems, remote control and signalling systems, and cable and wire products of all kinds. In addition, ITT companies in Europe are major suppliers to broadcast and television administrations, international airlines, railway undertakings, power generating boards, and other public utilities.

ITT conducts major manufacturing operations in five of the six Common Market countries (Belgium, France, Federal Republic of Germany, Italy and the Netherlands), as well as in each of the outer seven (Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom). ITT companies also manufacture in Finland and Spain.

Backing ITT strength in Europe is a massive research and development programme supported by a staff of 25,000 scientists, engineers, laboratory technicians and other specialists at work in central laboratories in the USA, England and France and in product-development laboratories at ITT factories throughout the world. A few of the products of ITT companies are listed and briefly described in this Telecommunications Review for the benefit of readers of the ITU Journal.

ITT World Headquarters,
320 Park Avenue, New York, N.Y., U.S.A.
ITT European Area Headquarters,
11 Boulevard de L'Empereur, Brussels 1, Belgium.

ITT

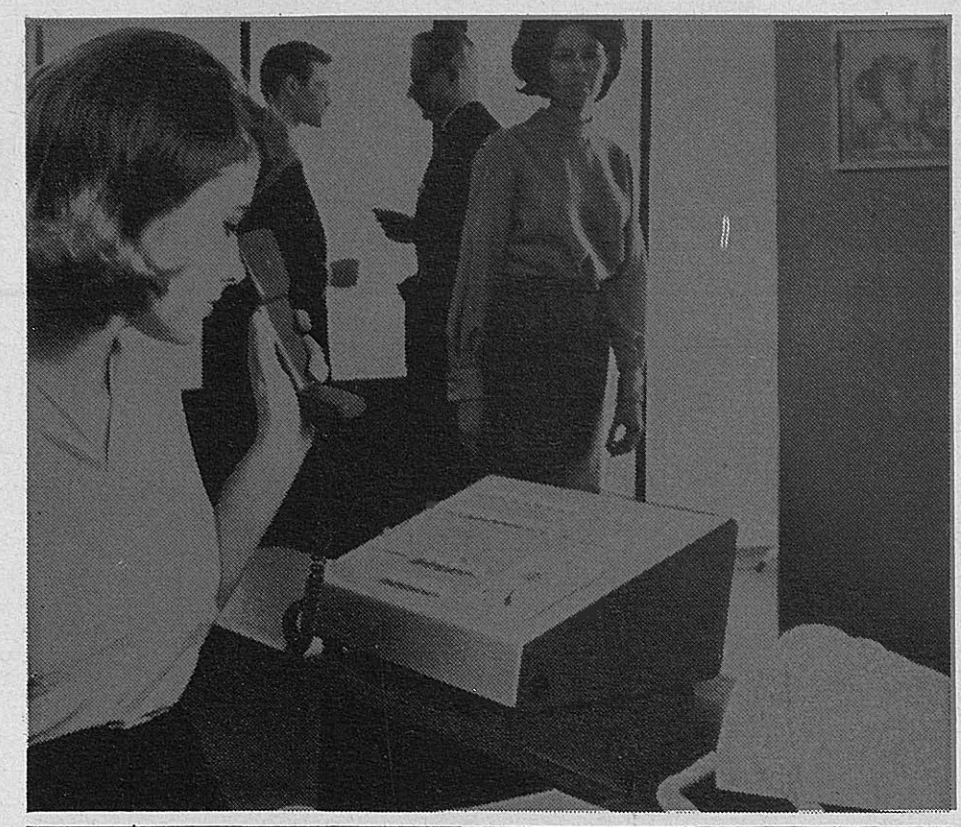


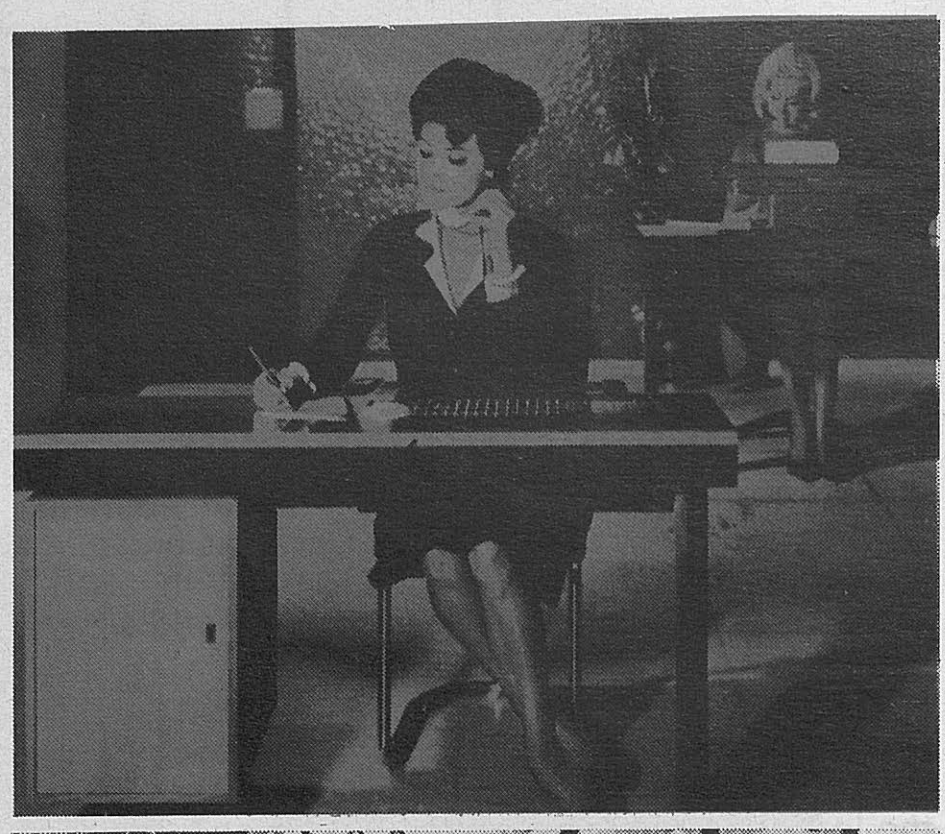
Data by phone

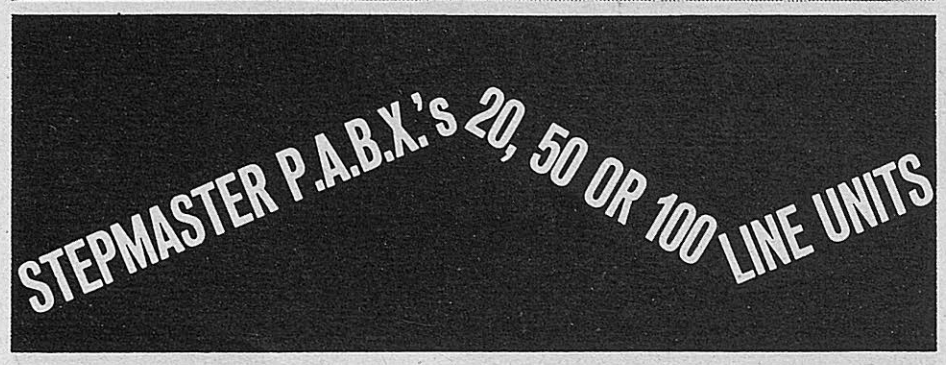
DATA BY PHONE . . . with up to 200 symbols per second. The introduction of electronic data processing, into an ever increasing number of concerns, has amplified the need for more rapid and efficient data transmission. The risk of distortion on normal telephone networks is in many cases not on a level with the demands made by data processing techniques. *ITT's system GH 201* is an error-detecting and error-correcting data communications system which makes the telephone network suitable for data transmission. Data can be transmitted, symbol by symbol, at speeds of up to 200 symbols per second. Faults are detected by means of a combined parity check and carrier control, and correction obtained by retransmission. Only correct data is recorded at the receiving end, thus simplifying the subsequent processing. On long test runs, under the most severe conditions, GH 201 has shown itself to be a most reliable instrument, fully able to meet the exacting demands of data processing techniques. The GH 201 is wholly transistorized and can easily be adapted to various kinds of external equipment.

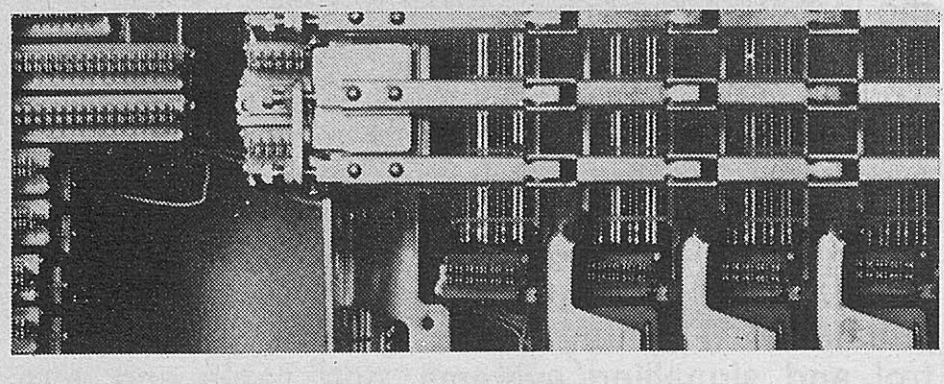
ITT's GH 201 is developed and manufactured by Standard Radio & Telefon AB, Veddestavagen 9-11, Barkarby, Sweden.

Standard Radio & Telefon AB









Good communication

Good communication facilities in an industrial organization are now recognized as a necessity at all administrative levels. Time saved by obtaining immediate contact with other members of the staff is of inestimable value to all, from the Managing Director to the junior clerk, and the capital cost of providing a properly planned system is small compared with the incalculable losses sustained by having inefficient communications. For many years STC has designed, manufactured and installed Private Automatic Branch Exchanges of various types. As a result of this experience a large fund of expert knowledge is available, and any technical advice that many be required will be furnished gladly on request. New light-weight high performance handset ☐ B.P.O. type "long life" components ☐ Transistorized ringing and tone circuits ☐ All "plug-in" type equipment ☐ Quick and easy expansion to full capacity ☐ Simple installation and maintenance ☐ Full tropical finish.

Standard Telephones and Cables Limited,
Telephone Switching Division, Oakleigh Road,
New Southgate, N.11, England.

STC

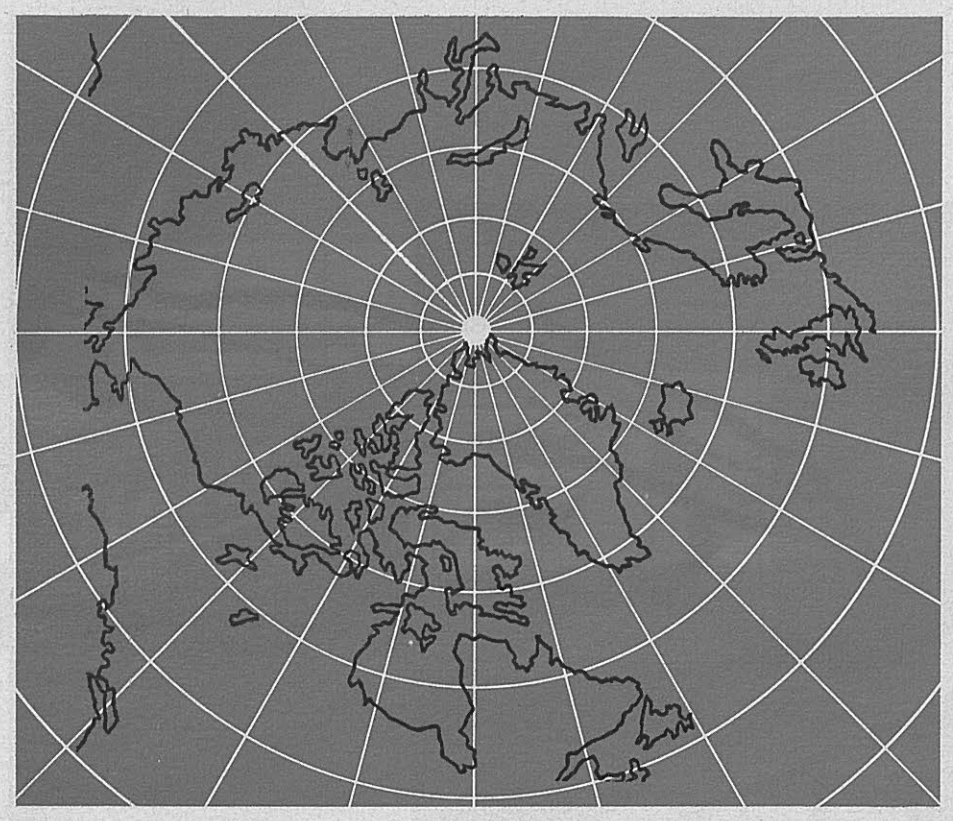
Pentomat . . . what's in a name?

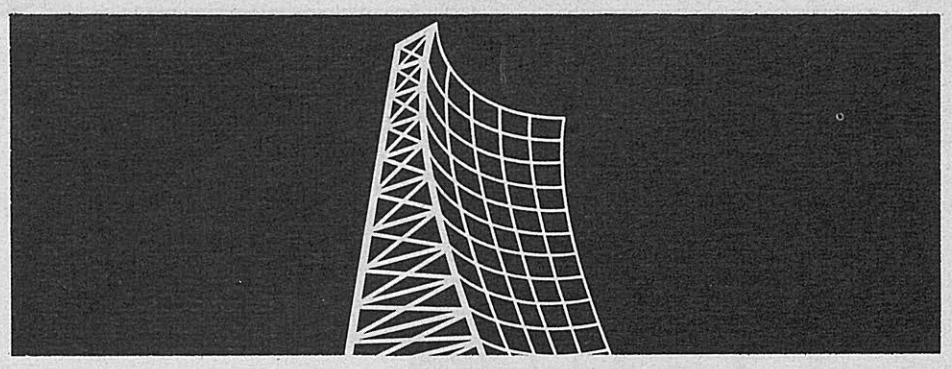
Is it Greek to you? . . . As a matter of fact, it is also for us. Pentomat relates to private automatic telephone exchanges using "Pentaconta" components. "Pentaconta" is the name of the ITT Crossbar System based on the application of a *Penta*conta multiswitch, which works aut*omat*ically. The Pentomat series already covers capacities ranging from 2 city lines/6 extensions up to 50 city lines/200 extensions. Crossbar switching with static line and ringing generators, assures high operation speed, improved transmission quality, and reduced maintenance and operating noise. It also provides the most up-to-date facilities used in private telephony.

"Bell" has an eight-decade experience in telecommunications. Make it yours!

Bell Telephone Manufacturing Company,
Francis Wellesplein 1, Antwerp, Belgium.

Bell Telephone Mfg Co





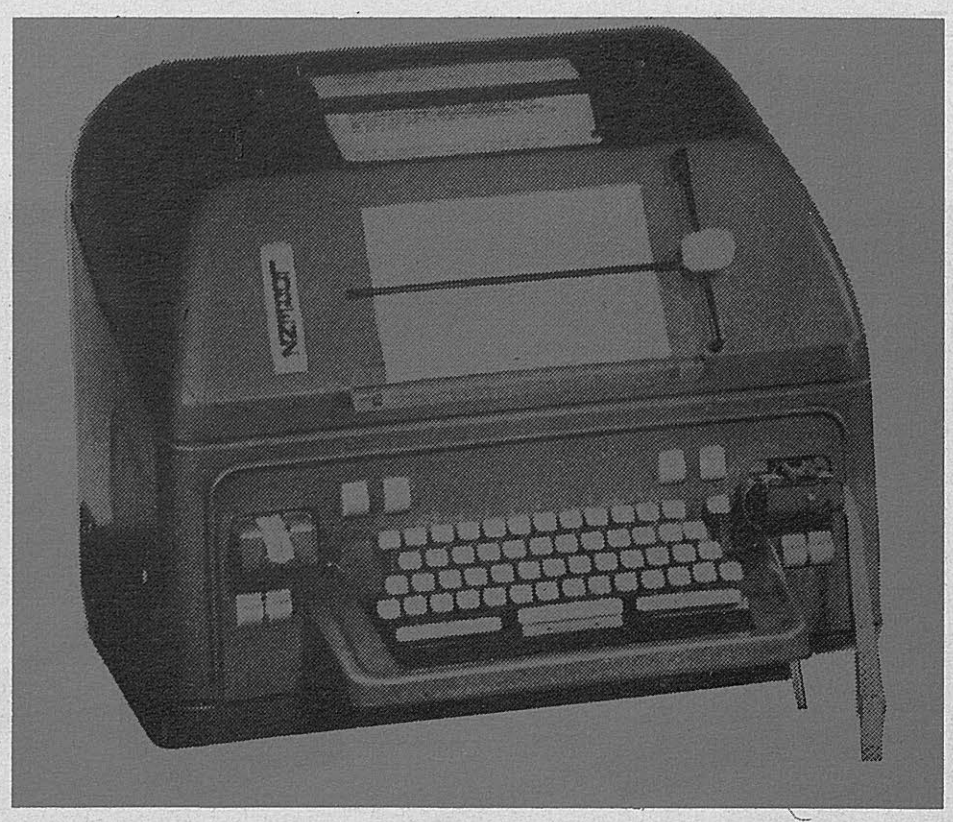
Troposcatter

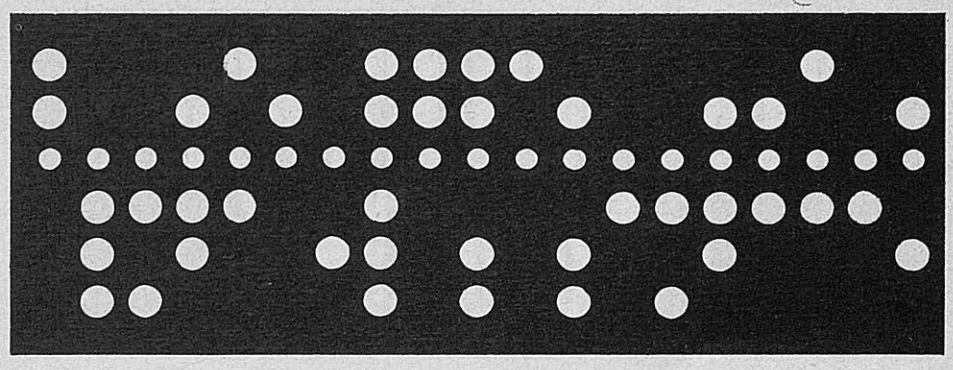
The S.910 Series radio equipment provides UHF communications systems for both troposcatter and line-of-sight operation. The construction is based upon the building block concept providing alternative configurations. The required operating frequency and channel capacity are obtained by inserting the appropriate modules. The system is designed to operate with standard pulse-code, pulse time or frequency division multiplex equipment. Video or other types of data can also be used.

- Frequency bands 1·7—8·5 Gc/s
- 1—240 channels
- Up to quadruple diversity
- Parametric amplifier (optional)
- Phase-locked threshold extension (optional)
- Low power consumption
- Fully transistorized with exception of the output Klystron

Standard Telephones and Cables Limited,
Radio Division, Oakleigh Road, New Southgate,
London, N.11, England.

STC



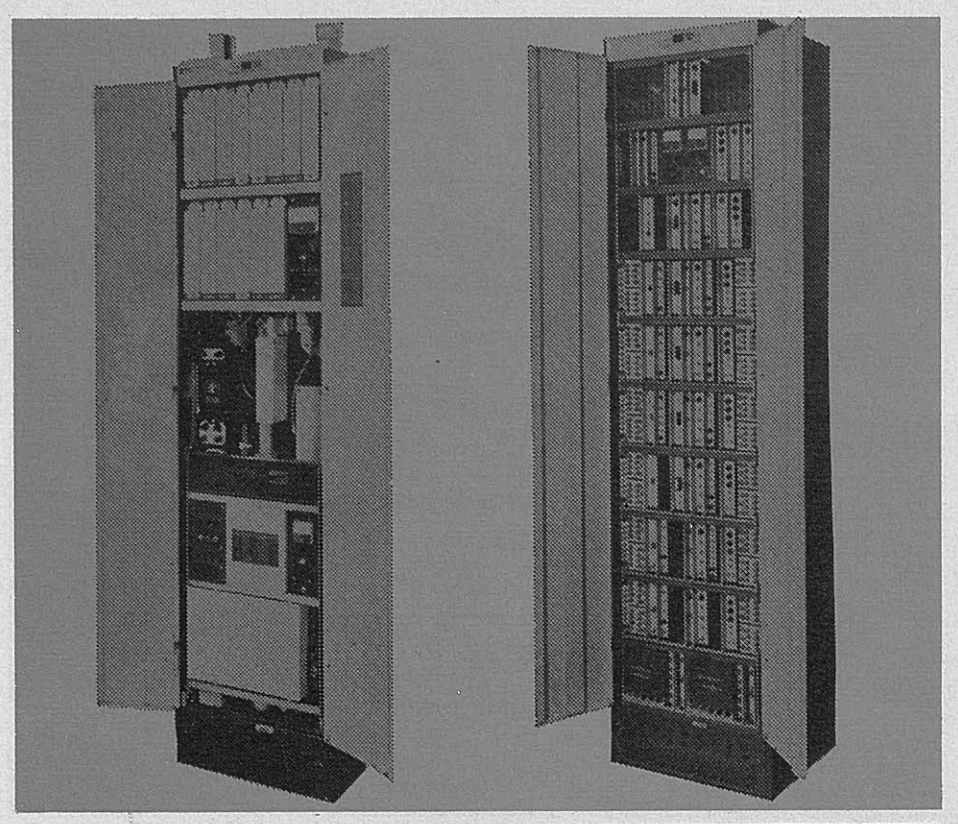


Lorenz teleprinter LO 15C

The Lorenz Page Printer features every progress made in the field of teleprinter engineering. A smooth ribbon feeding and the moving type bar carriage permit easy reading on the local record copy of incoming and outgoing messages. Reperforator and tape transmitter attachments allow operation with the internationally admitted print-out rates and, thus, maximum exploitation of the teleprinter.

Standard Elektrik Lorenz A.G.
42 Hellmuth-Hirth-Strasse, Stuttgart-Zuffenhausen,
Federal Republic of Germany.

SEL



RL6B MICROWAVE RADIO LINK

1800 telephone circuits/ maximum transistorization

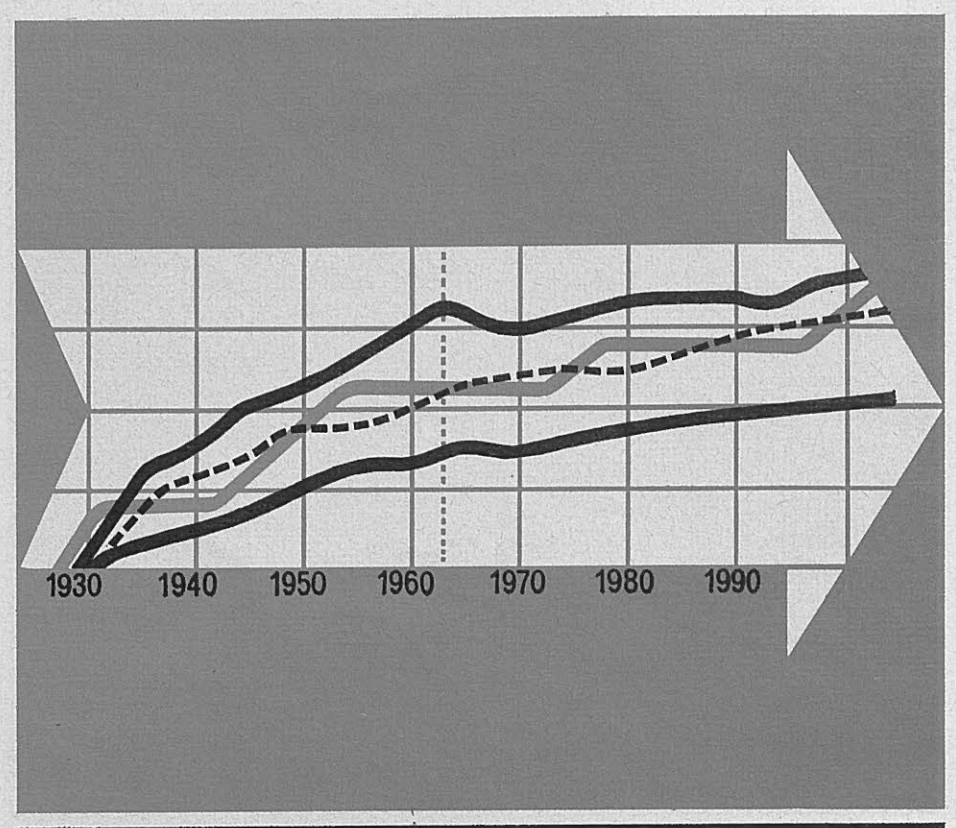
The 6Gc/s microwave transmission system, RL6-B, can transmit 1800 telephone channels or colour T.V. plus sound per radio channel. Designed to use the C.C.I.R. frequency plan, it will provide up to 8 broadband radio channels on one route. Maximum use of transistors, high performance level, and all-round operational economy are the essential features of the RL6-B.

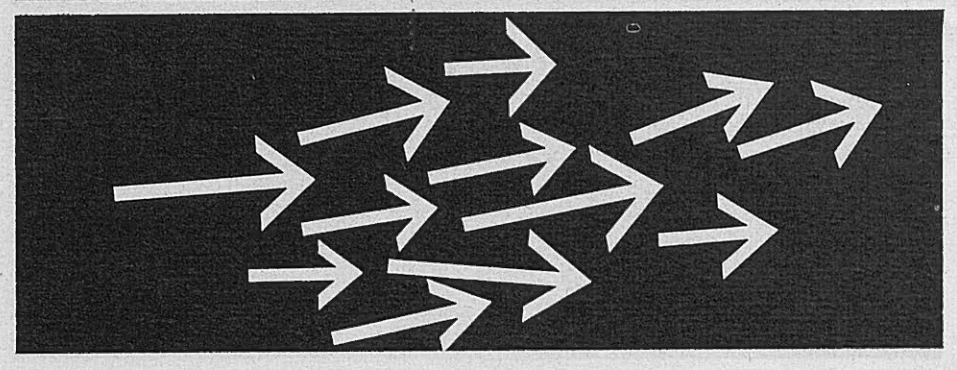
Main features of the RL6-B:—8 broadband radio channels. C.C.I.R. performance. 10 watt output power from periodic permanent magnet focusing TWT. Transistorized throughout except TWA and the modem cubicle. 960 telephone circuit version also available. Switching systems available for N+1 or 2 protection channels. Aerials and towers can be supplied. All solid state narrow-band auxiliary link. Cassegrain antenna for single or bi-polar operation.

By extensive prefabrication, and simplification of space and installation requirements, considerable savings in commissioning time and a lower overall cost have been achieved. Systems for mains and battery operation can be supplied and a 960 telephone circuit version is also available for lower density traffic routes.

Standard Telephones and Cables Limited,
Transmission Systems Group,
Basildon, Essex, England.

STC





Way ahead

Planning to meet future national and international needs in telecommunications requires wide experience and highly specialized know-how. STC has both. It calls for a team in possession of all the facts, with the ability and understanding to interpret them—assessing requirements for up to twenty years ahead. STC has such a team. The Market Development Department of the Transmission Systems Group maintains a steadily growing storehouse of network and relevant data—social and economic characteristics, equipment design trends, population growth and movement, industrial and agricultural development—all under constant review. This process of continuous assessment and interpretation of maximum information, aided by special surveys, enables STC to forecast trends and requirements . . . to meet tomorrow's problems half-way.

Administrations interested in 5-year or long term planning are invited to contact STC for further information on the available services.

Standard Telephones and Cables Limited,
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ITT in Europe since 1879, employing more than 123,000 Europeans, 26 companies, 113 plants, manufacturing in virtually every country in Western Europe. Enquiries for products should be addressed to companies advertising.

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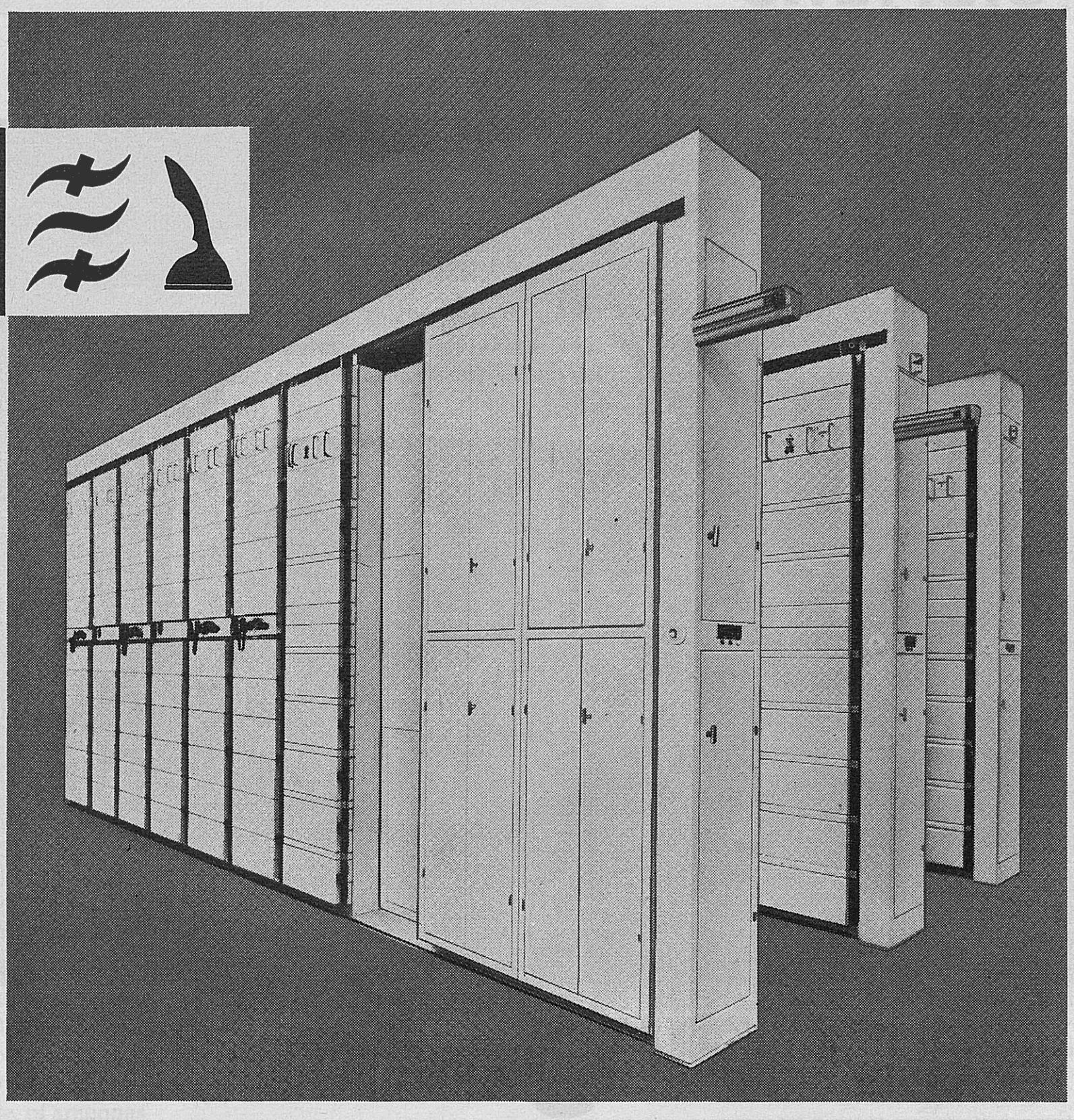

Terminal multiplexing equipment for a 2700-circuit carrier system in a large station.

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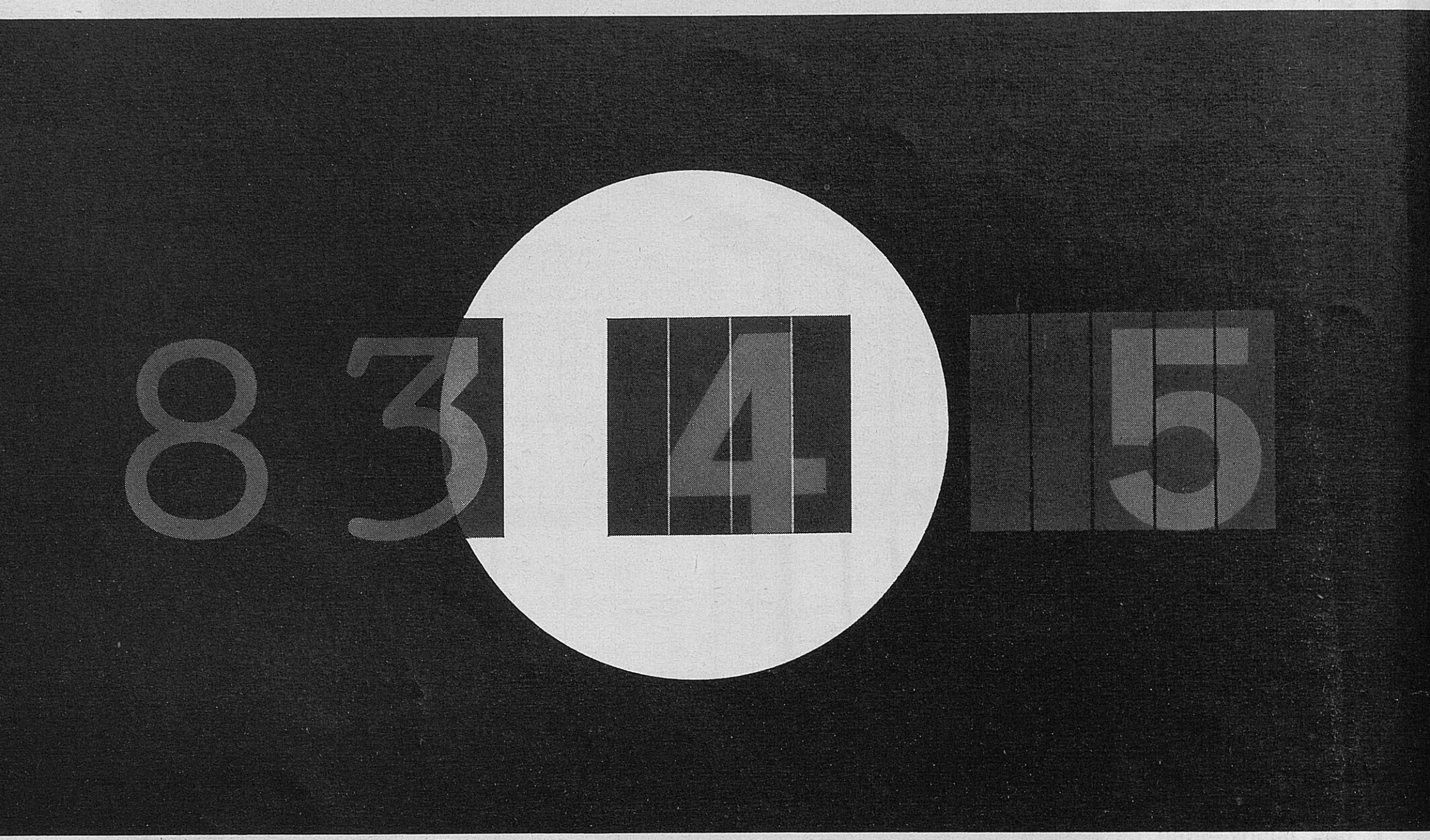


encoding

130-14-41

Because machines understand only their own language, all information that is to be fed to them must first be encoded.
It is the goal of technology to automate this otherwise time-consuming encoding routine. In telephone engineering, encoding has long been automated: the telephone dial encodes all digits that are dialed into pulse trains, while at the dial office translators decode this pulsed information to determine the office area and identity of the wanted party; for international calls the pulse code is automatically translated into a multifrequency code at the point where the telephone network of one country joins that of another.

SIEMENS & HALSKE AKTIENGESELLSCHAFT
WERNERWERK FÜR FERNSPRECHTECHNIK · MÜNCHEN

The Siemens Group has made significant contributions to progress in encoding and transmitting dialed information:

1925 Long-distance a-c signaling introduced for long-distance lines exposed to influence of power parallels
1928 1 VF signaling adopted by German PTT
1930 Inductive signaling introduced on sectionalized party lines and long-distance dialing lines of private communications network of German State railroad
1939 2 VF signaling adopted by German PTT
1960 MFC signaling adopted for transatlantic telephone communication

New dial office switching systems call for new encoding techniques for exchanging information between switching devices. In electronically controlled switching systems dialed information is fed to the markers in parallel code in order to shorten holding times.

CCIR STUDY GROUP MEETINGS IN MONACO

Four CCIR Study Groups have been meeting recently in Monte Carlo. These are Study Group IV (Space systems and radio astronomy), Study Group VIII (International monitoring), Study Group IX (Radio-relay systems), and Study Group VII (Standard frequencies and time signals).

Study Group IV, which met from 10 February to 2 March, had, in addition to its normal work, been entrusted with several tasks by the 1963 Space Radiocommunication Conference. In order to expedite the work, its Chairman, Professor I. Ranzi of Italy, organized the meeting on the basis of sub-groups, and this was largely responsible for the meeting's success.

Sub-Group IV A, dealing with technical considerations, treated subjects relating to noise, time delays, antennas, multiple access, modulation techniques and broadcasting. It took into account the findings of the CCITT IIIrd Plenary Assembly regarding tolerable limits of delay time and switching discontinuities. It studied a new angle-modulation technique in relation to bandwidth necessarily occupied. Finally, it proposed a characteristic which embodied isotropic gain, as a function of azimuthal angle, of antennas of all sizes, thus making calculations much simpler for design purposes.

Sub-Group IV B, which was concerned with sharing problems, had the formidable task of reviewing the methods of calculation of the co-ordination distance, a subject which was entrusted to the CCIR by the Space Radiocommunication Conference. It was found that the method adopted by the conference contained several inaccuracies, particularly in connection with the site-shielding factor. It was decided that this problem would require further studies.

Sub-Group IV C, which dealt with space links for research, meteorological and navigational satellites, and Sub-Group IV E, on radio astronomy, revised existing Reports, taking into consideration new data that had been accumulated.

Sub-Group IV D, on propagation problems specifically concerned with space systems is interested in the work of CCIR Study Groups V and VI on tropospheric and ionospheric propagation, and it was decided that propagation questions should be treated by those two study groups.

In addition to these five sub-groups, a working group was set up to study definitions of terms.

Insofar as sharing will take place between space systems and radio-relay systems, many documents relevant to this problem also have to be studied by Study Group IX.

Their Serene Highnesses, Prince Rainier and Princess Grace receive the Chairmen and Vice-Chairmen of CCIR Study Groups IX and IV and senior ITU officials.

Study Group VIII

In the light of technical development since the Xth Plenary Assembly of the CCIR, Study Group VIII proposed revisions to most of the existing Recommendations and Reports it had drawn up previously. Its most important work however was to draft new texts which will be of effective assistance to monitoring stations.

Among these texts are a draft Recommendation and a draft Report on an expeditious method of determining field-strength in monitoring stations and a draft Recommendation on bandwidth measurement.

Three draft Reports are of importance especially for the new and developing countries. They are: international monitoring in new and developing countries; direction finding at monitoring stations; and antennas for monitoring stations.

To help in the identification of sources of interference to radio reception, the necessary steps have been taken to begin shortly the publication of the catalogue mentioned in CCIR Resolution 16. This is a collection of information such as photographs, magnetic tape recordings, word descriptions, drawings, etc. describing interference.

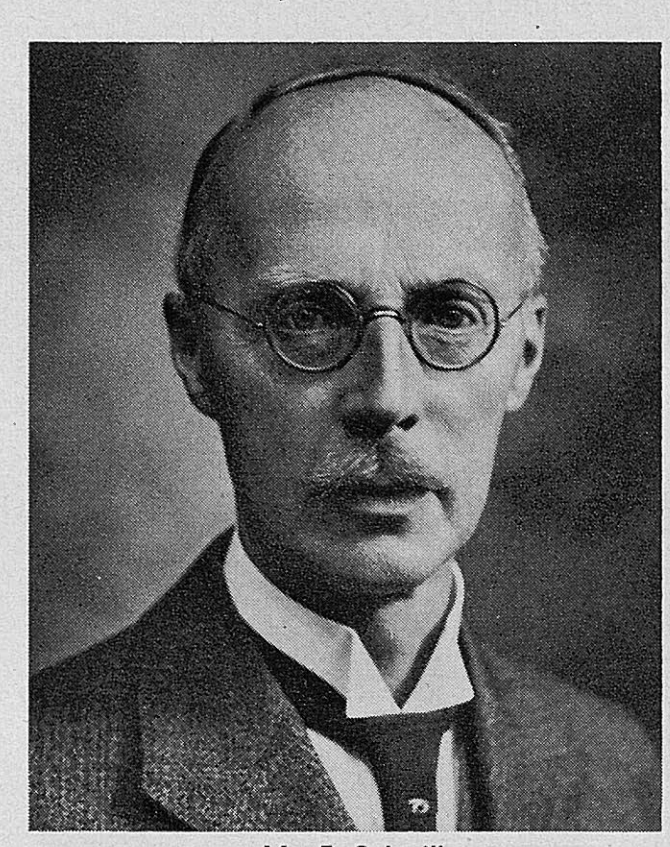
The need to have a manual for monitoring stations and to improve the exchange of technical information between them has prompted Study Group VIII to prepare a draft Resolution and a draft Study Programme on this subject.

The meetings of Study Groups IX and VII are still continuing as we go to press.

Death of Mr. Franz Schwill

Mr. Franz Schwill, former Vice-Director of the Bureau of the Union when it was still in Berne, died on 15 February, at ninety years of age, in the Swiss capital.

It was in 1906, as Secretary of the first International Radio Conference in Berlin, that Mr. Schwill came into contact with the International Telegraph Office. As Mr. Corbaz, Assistant Chief of the



Mr. F. Schwill

Department of Technical Co-operation, pointed out in the tribute he paid to the deceased on 18 February, Mr. Schwill understood at that time the significance of the new tasks which had devolved upon the International Telegraph Union, and in 1908 he accepted his appointment to the " Berne Bureau ", as is was called outside Switzerland.

He set up a section which was to furnish countries all over the world with documentation that steadily increased in scope. His love of precision, enthusiastically communicated to his colleagues, earned for the work accomplished under his direction a reputation for reliability among all the Administrations of the world.

After he became Vice-Director of the Bureau on 1st July 1918—a post he left in 1945 for a well-deserved period of retirement—Franz Schwill was able to demonstrate the full extent of his devotion to the principle of collaboration between nations. It would take too long to list all the international conferences in which he took such an active part during a career of fifty-two years in the service of telecommunication. What one remembers is the esteem in which he was held because of his perpetual good humour, his thorough grasp of the problems involved and his great gift of conciliation which allowed him to smooth out situations that were often very trying.

technical co-operation

Expert back from Korea

Mr. Hubert G. Arthur, supervising engineer of the New Zealand Post Office, returned on 7 February from Korea where he completed his third assignment as an ITU expert. Previous missions have taken him to Libya in 1960 and in 1962.

During his 10-month stay in Korea, Mr. Arthur advised the Office of Radio Regulatory, the division of the Ministry of Communications which deals with control and operation of all radio services in the country, on the application of the ITU Regulations, planning of frequency allocations, and location and elimination of harmful interference. He also gave advice on planning of frequency assignments for navigational beacon services, medium-frequency broadcasting and other services.

On a recent visit to Geneva headquarters, Mr. Arthur stated: " My task was made easier by the fact that the Office of Radio Regulatory is well-organized and has technically-advanced personnel who are oriented toward international co-operation. They know what to do. I only helped them with the details. They deserve a lot of credit. "

During his mission Mr. Arthur visited and inspected various radio monitoring stations throughout the country, established a channel plan for VHF mobile and fixed services, and initiated national conferences on the co-ordination of navigational beacons. He also wrote a handbook on Radio Frequency Management which the Korean Ministry of Communications has published for use as a reference in band planning and training courses.

Mr. Arthur's mission was arranged in connection with the United Nations Expanded Programme (EPTA).

BEHIND THE SCENES

Twelve miniatures from headquarters

3 — ANITA RAMMA

A magazine is a complex product. Authors, photographers, editors feed in the raw material. Printers eventually roll it off the assembly lines. A fact too seldom appreciated is that between these two stages there is an immense amount of work to be done in ensuring that the raw material is properly prepared for the men on the machines and in checking afterwards that it has been properly treated by them. Accuracy—the supreme virtue for any publication—depends entirely on this.

The guardian of the *Telecommunication Journal*'s virtue is Anita Ramma, its Chief Editorial Assistant. Combining in her Italian soul the hard-working tenacity of the Piedmont of her childhood and the spontaneous exuberance which characterizes the country as a whole, she scrutinizes everything in the *Journal* from mathematical formulæ to picture captions to commas with a tender watchfulness that is almost maternal.

Having worked for the ILO both in Geneva and Rome, she came to the ITU in 1948 and has been helping to hold the *Journal* together since 1954. Bilingual in Italian and French, and speaking also Spanish, English and German, she adores travelling since it enables her to indulge her passion of getting to know the history of different countries through their art and language. A precious passion for an international official in an international age.

national

The public land mobile service in the Federal Republic of Germany

The public land mobile service was set up some years ago by the *Deutsche Bundespost* for the purpose of establishing calls between radiotelephone stations in vehicles and telephone stations of the public telephone network. This service which is operated on specific frequencies in the VHF band is mainly used by commercial, economic and industrial undertakings as well as by public utilities and transport undertakings wanting to contact offices or dwellings from their vehicles by telephone, to make important business calls or to receive in their vehicles information or instructions from their headquarters. There is no need to point out that substantial amount of time and money can be saved by this new means of communication. Increase use of these facilities is also made by various authorities in certain matters.

The following statistics prove that the interest in and the use of this service has increased considerably since this service was first provided. The number of users amounted to approximately 450 in January 1959 and to approximately 800 in January 1961. There has been a continuous increase in this number. In January 1963 as many as 1423 subscribers made use of this service, and by 1 September 1964 the number of subscribers had again increased considerably, i.e. to 2300 subscribers.

Systematic expansion

This development is mainly due to the fact that in the course of the years the Deutsche Bundespost has expanded the network of base stations systematically according to the current requirements. This was achieved by setting up new base stations and by expanding base stations already in operation, i.e. by providing additional radiotelephone channels at these stations. Thus, 31 base stations with 55 radiotelephone channels were operated by this service in January 1961, while by 1 August 1964, as many as 58 base stations with 99 radiotelephone channels had been set up within the Federal Republic of Germany and were available for the establishment of radiotelephone calls.

The expansion of the network of base stations will be continued in the future years, because of the obvious demand for such facilities. For the years 1964/65 the operation of approximately 15 additional base stations is planned and arrangements have been made for this purpose, for instance in the areas around Ulm, Schweinfurt, Bamberg, Fulda, Tübingen, Rottweil, Donaueschingen, Ravensburg, Regensburg, Deggendorf and Passau. Furthermore, provisions have been made for expanding the existing base stations by a total of more than 20 radiotelephone channels, for instance in the areas around Bremen, Bremerhaven, Hamburg, Hanover, Stuttgart, Düsseldorf, Essen, Mannheim, Frankfort on the Main, Dortmund, Munich, Cologne, Coblenz and Bonn.

Increase in number of calls

It is not surprising that with the expansion of the service and with the increase in the number of subscribers, the number of calls has increased accordingly. Whereas in 1959 about 608 000 calls were established, the number of calls amounted to approximately 1 348 000 in 1963.

The statistics on the number of calls made up to the end of July 1964 give reason to expect that more than 1 560 000 calls will have been made in 1964.

A remarkable feature in the development which could be observed with regard to the type of vehicles equipped for this service is that this service has, to an increasing extent, proved to be particularly appropriate and useful for

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Telephones on the Tigris

The first of three mobile telephone exchanges designed and manufactured by Stromberg-Carlson Corporation for the Government of Iraq is now in operation in Baghdad, providing telephone service for 900 subscribers in the Mamoon section of the city. The mobile trailers, each of which contains a complete XY telephone system, will be used at various locations to relieve the acute communication situation until permanent telephone buildings can be constructed.—*Stromberg-Carlson.*

(Stromberg-Carlson)

the establishment of calls to and from motor vehicles. At the end of 1959, 54% of the total number of vehicles equipped with radiotelephone stations for this service were ships (ships in inland ports and on inland waterways), and 46% were land vehicles (motor vehicles and long-distance trains of the *Deutsche Bundesbahn*), while at the end of 1963 this proportion has changed to the advantage of the land vehicles, i.e. to 32.5% ships and 67.5% land vehicles.

The Deutsche Bundespost endeavours to promote the technical development of this service with the aim of facilitating automatic calls to and from radiotelephone stations in vehicles on the model of the public telephone network which to a large extend operates automatically. Tests and trials in this field have been in progress for some time. — *Federal German PTT.*

Developments in Ethiopia

The 1965 budget of expenses of the Imperial Telecommunication Committee is 16 million Ethiopian dollars. It covers the installation of automatic exchanges, local networks, national and international radiocommunications, long-distance networks, the purchase of land, and the construction of buildings.—*L'Ethiopie.*

Sombre speed

The biggest rush operation in the history of London's telephone system—providing special lines for sight and sound broadcasts of the lying-in-state and funeral of Sir Winston Churchill—was carried out between 24 and 29 January.

This operation, underpinning the great network of permanent circuits that the United Kingdom General Post Office is able to provide for Press and broadcast coverage of all State occasions, was on an even bigger scale than those mounted for the funeral of King George VI and the Coronation of Queen Elizabeth II.

Working day and night, telephone engineers of the City and centre areas laid more than 900 extra camera, speech and music circuits, using nearly eight kilometres of specialized cable—and 14 multi-channel tubular cables into the crypt of St. Paul's cathedral.

From the cameras and microphones set up in Westminster and along the funeral route, from ancient landmarks with historic names—Pudding Lane, Botolph Lane and Red Bull Wharf—from the Tower of London and rooftop vantage points overlooking the River Thames, the lines snaked back through underground conduits, along the pavements and the faces of buildings and overhead, to join the main network at strategic points. From these points several hundred additional circuits went out to the television control centres set up in the cities of London and Westminster. The lines went on to connect with telephone exchanges where the radio and television organizations had been provided with special facilities. The solemn booming of the funeral guns was also controlled by signals sent over Post Office lines laid during the week.— *United Kingdom General Post Office.*

François de Loriol

Mr. François de Loriol, Assistant Director of *Radio-Suisse, S.A.*, died in Berne on 16 February 1965 following a heart attack.

(Radio-Suisse SA)

Mr. F. de Loriol

Born in Thun in 1911, he graduated as an electrotechnical engineer at the Federal Polytechnic School in Zurich. After a period of training with the Marconi Company in London, he joined Radio-Suisse, the wireless telegraph and telephone company, in 1937. His first post was at the Münchenbuchsee transmission station, where later he became assistant to the Chief Engineer, Mr. S. Anselmi, whom he succeeded in 1958.

He was promoted head of department, and then chief assistant to the Director, before he became Assistant Director on 1 January 1964.

Mr. F. de Loriol, who was extremely well liked in international telegraph circles, took a most active part, from 1953 onwards, in the work of the CCIR. He attended many ITU conferences and made a valuable contribution to the development of telecommunication.

North Sea oil drilling telecommunications

The United Kingdom General Post Office is providing special equipment at three of its east coast radio stations (Humber Radio, Cullercoats Radio and Stonehaven Radio) to handle theaddi tional traffic resulting from North Sea drilling operations. The drilling rigs will be regarded as ships and as such will additionally have access to the public correspondence services provided by the Post Office coast stations on the east coast. These stations provide for ships at sea practically all the telephone and telegraph services that are available on shore.

The present public correspondence circuits could not carry all the communications that will ultimately be required for the drilling operations and the Post Office programme is, therefore, designed to keep pace with the growth of drilling operations. By May 1965 Humber Radio will be able to provide twelve radioteleprinter circuits which will be connected to the shore bases of the oil rigs. These channels will be on the upper sideband of a single sideband transmitter. In August 1965 these facilities will be extended to 24 channels and Stonehaven Radio will be similarly equipped. At the same time Cullercoats Radio will be equipped to provide two single sideband radiotelephone channels for the exclusive use of the oil drilling rigs and telephone subscribers on shore.

The same safety services will be available to the rigs as are already provided by the Post Office for ships at sea: distress watch, weather bulletins, gale warnings and a free medical advice service. — *United Kingdom General Post Office.*

Personnel changes...

... in Italy

Mr. Ernesto Lensi has been appointed Chief Inspector General of Telecommunications and Mr. Matteo Fariello Director of the State Telephones Administration.

... in Jordan

H. E. Fadel Dalqamuni became Minister of Communications PTT replacing H. E. Nizam Sharabi.

... in the Syrian Arab Republic

Mr. Nazih Raslan has been appointed Director-General of Posts and Telecommunications.

British adopting photographic system to read telephone exchange meters

A photographic system for reading telephone exchange meters is being introduced nationally by the British General Post Office after extensive tests at Edinburgh cut the reading time for 1000 meters from four hours to ten minutes. Earlier experiments with photographic meter reading over a number of years had been abandoned due to technical difficulties and prohibitive costs.

The process now being used results in a shadow-free picture of 100 meters on under a square inch of film. Some 3500 meters can be " read " before the camera needs re-loading.—*Telecommunications Reports.*

Ten million television licence-holders in the Federal Republic of Germany

The Federal Republic of Germany, with a population of approximately 58 million, issued its ten-millionth television licence in December 1964.

By 1 January 1965 this figure had already risen to 10 023 988. The increase in the number of licences last year was one and a half million. — *Bundesministerium für das Post- und Fernmeldewesen.*

international

Progress on Seacom

The total estimated cost of the South East Asia Commonwealth Telephone Cable project (SEACOM) has been increased by US $12 850 000. This is to cover the cost of routing the 7250 kilometres cable from Hongkong to the American island of Guam to link with Madang (New Guinea) and Cairns (Australia); and to the decision to increase the capacity of the cable from Guam to Cairns to 160 telephone channels. (The Commonwealth telephone cables across the North Atlantic and Pacific—CANTAT and COMPAC— are both 80-channel systems).

The first 3225 kilometres of Seacom have been laid; the Singapore-Jesselton (Sabah) section is already in service and the Malaysia-Hongkong link opens at the end of March. The whole project to Australia is scheduled for completion by the end of 1966, and will link into the existing Commonwealth system to London and Europe.

According to Mr. H. H. Eggers, Managing Director of Cable and Wireless Limited, the decision to increase the channel capacity of Seacom was necessary to deal with the great volume of traffic with Japan. The Seacom landing at Guam will provide interconnection with the Japanese-United States Trans-Pacific telephone cable. Mr. Eggers also said that the Hongkong-Guam section would open a few months before the whole project was completed.

Large contracts have been placed with various manufacturers: Standard Telephones and Cables Limited, and Submarine Cables Limited will supply all cable and repeaters; Associated Electrical Industries Limited (AEI) will supply terminal equipment. All materials are being purchased in Australia, New Zealand and Canada.

Seacom is a Commonwealth partnership undertaking of five countries:-Great Britain, Australia, Canada, New Zealand and Malaysia. The British partner is Cable and Wireless Limited who meet 46 per cent of the total cost of 66 million dollars.

Cable laying operations by *HMTS Monarch* and *CS Mercury* (the 8960 tons gross Cable and Wireless cablelayer) commence from Hongkong this summer and will continue into November 1966. The cablelayers will make five round trips from London.

Approximate cable route distances—Jesselton-Singapore 860 nautical miles; Jesselton-Hongkong 1050 nautical miles; Hongkong-Guam 1880 nautical miles; Guam-Madang 1220 nautical miles; Madang-Cairns 1550 nautical miles.

Hongkong and South East Asia at present depend on radio for international communications. Seacom is the first telephone cable in this area.—*Cable and Wireless Limited.*

New cables in the Caribbean

The Eastern Caribbean project of Cable and Wireless (West Indies) Limited is to be further developed. Application has been made to the Governments of Bermuda and the British Virgin Islands for landing licences to lay an 80-channel telephone cable between Bermuda and Tortola. This main trunk route will provide through circuits of improved quality and number for the international telephone, telegraph and telex services of the Eastern Caribbean. It will replace existing HF radio services with their inherent problems of fading and interference.

In January 1964 the company announced a major project for the Eastern Caribbean and is now in the process of

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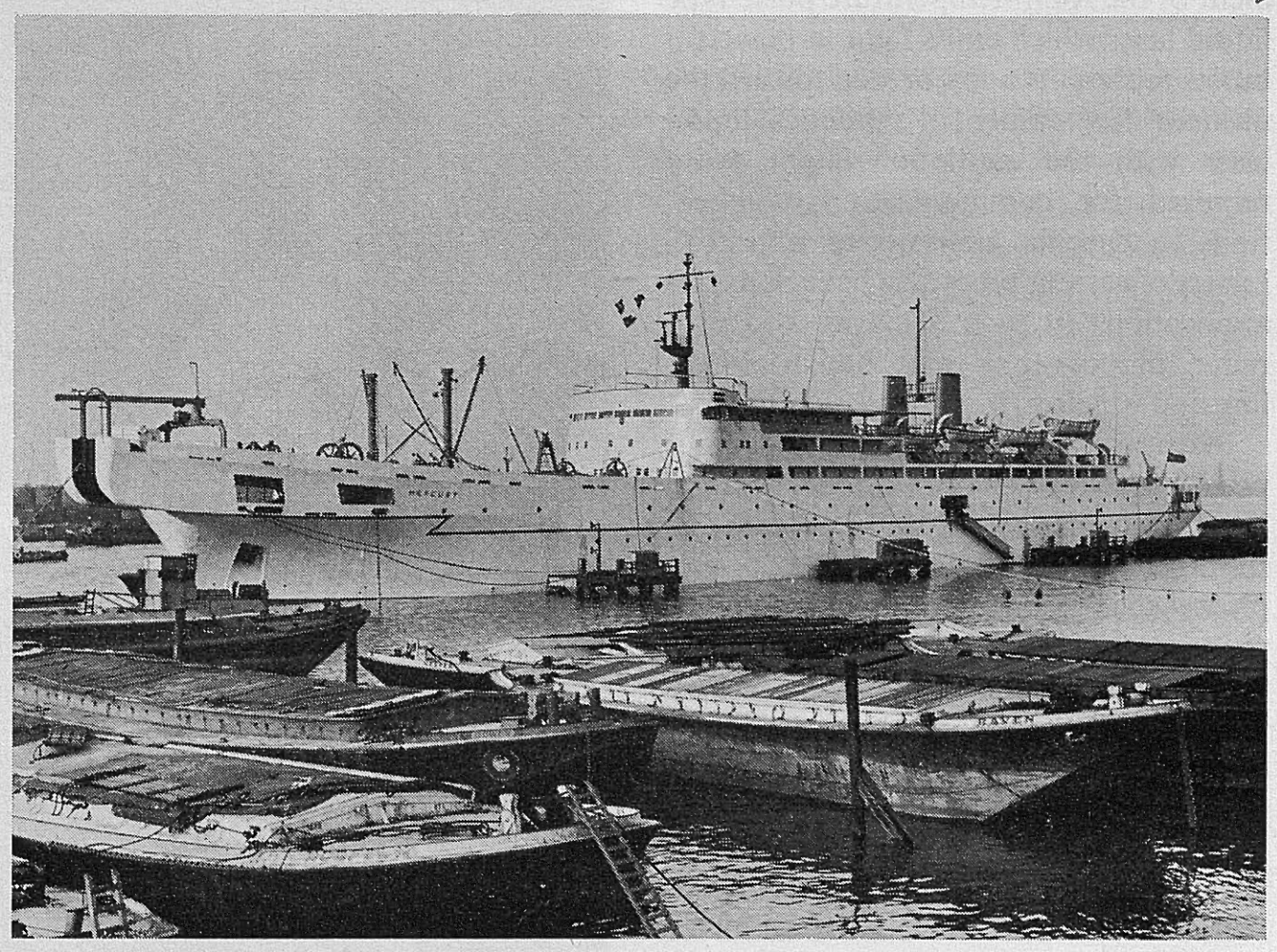


(Submarine Cables Limited)

Cable ship Mercury *loading transocean submarine telephone cable at the Greenwich Works of* Submarine Cables Limited.

establishing a multi-channel tropospheric scatter and microwave system which will introduce the most up-to-date external communications for Antigua, Barbados, Dominica, Grenada, Monserrat, St. Kitts, St. Lucia, St. Vincent and Trinidad.

A multi-channel tropospheric scatter system between Barbados and Trinidad together with certain inter-island VHF links in the Leeward and Windward Islands have been in public service since 1960/61 and the integration of these existing links with the new tropospheric scatter system between Barbados—St. Lucia–Antigua is already well under way.

The planned new expansion of the project now provides for the northern-most tropospheric scatter link to connect Antigua with Tortola in the British Virgin Islands, where the company will open a new branch. Tortola is some 24 kilometres from St. Thomas and a line-of-sight radio link will be introduced between the two islands. The main Eastern Caribbean trunk route northwards from the British Virgin Islands will be the company's 80-channel telephone cable to Bermuda.—*Cable and Wireless Limited.*

technical

Room-temperature liquid laser

Development of a liquid laser which is the first of its kind to produce light pulses at normal room temperatures has been announced by General Telephones and Electronics (GT&E) Laboratories Incorporated.

While previous liquid lasers required a temperature of minus 100 degrees centigrade, the new laser is capable of producing pulses of light at 20 degrees centigrade.

Emits light in powerful bursts

According to Dr. Lee L. Davenport, President of the Laboratories, development of the room-temperature pulse-type liquid laser which emits light in powerful bursts represents a major step toward the ultimate development of a practical liquid laser with the continuous light beam required for communications applications, a specific laboratories objective. Lasers of various types also have potential applications in such fields as medicine, radar, photography, and industrial drilling and welding.

Because a continuously operating laser produces a steady, highly intense beam, it has the theoretical capacity of carrying simultaneously more than 100 000 telephone channels or more than 160 television programmes. This compares with a maximum capacity of present broadband point-to-point microwave systems of 6000 simultaneous telephone channels or ten television programmes.

" Much work needs to be done over the next five to ten years before laser communication links can be considered for application on a practical basis," Dr. Davenport said. " But this development of a room-temperature liquid laser is one of those steps toward the ultimate utilization of lasers in communications. "

Combines europium with chelate

The material which is instrumental in producing a laser light beam can be a crystalline solid, as in a ruby laser; gaseous, as in a neon-helium laser; or liquid as in the new laser. In this new liquid laser, the rare earth element europium is incorporated in an organic compound called a chelate, which in this case is benzoyltrifluoracetonate. The material is dissolved in acetonitrile, an organic solvent.

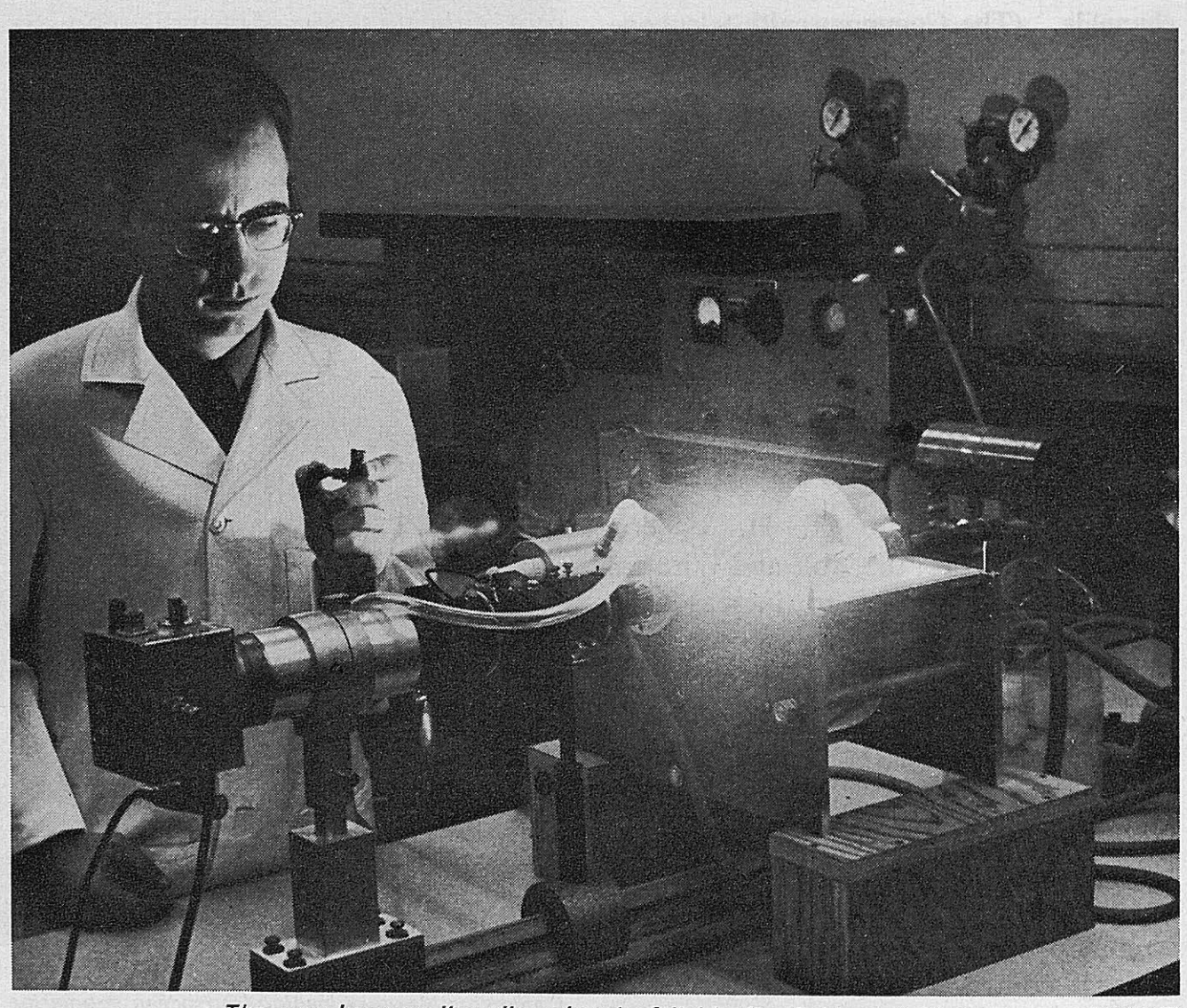
The chelate system used in the liquid laser is unusual in that the pump energy (the energy which activates the laser action) is absorbed in the large organic part of the molecule and is then efficiently transferred to the rare-earth ion. This differs from the non-chelate system where the optical-pump energy is absorbed by the rare-earth ion itself.—*GT&E.*

New United Kingdom radio telescope

A new United Kingdom radio telescope, operating at wavelengths in the region of one millimetre and incorporating a 4.57-metre diameter dish aerial built by the Marconi Company is now being used by research scientists from Queen Mary College, London University, to examine the brighter planets and radio sources in the sky.

This aerial, one of the largest ever built to operate at this wavelength, has been moulded in glass fibre reinforced plastic, with a final reflecting surface of sprayed zinc. The final average (root mean square) measured accuracy of the entire surface was within five thousandths of an inch (13/100 mm) of the specified paraboloid, an accuracy almost as great as could be achieved by using cast iron or invar, and at a fraction of the cost of these more conventional methods.

The radio telescope is situated at Coxtie Green, near Brentwood, Essex.—*Marconi News.*



The new laser as it emits a burst of light after being activated (GT&E)

radio wave propagation:

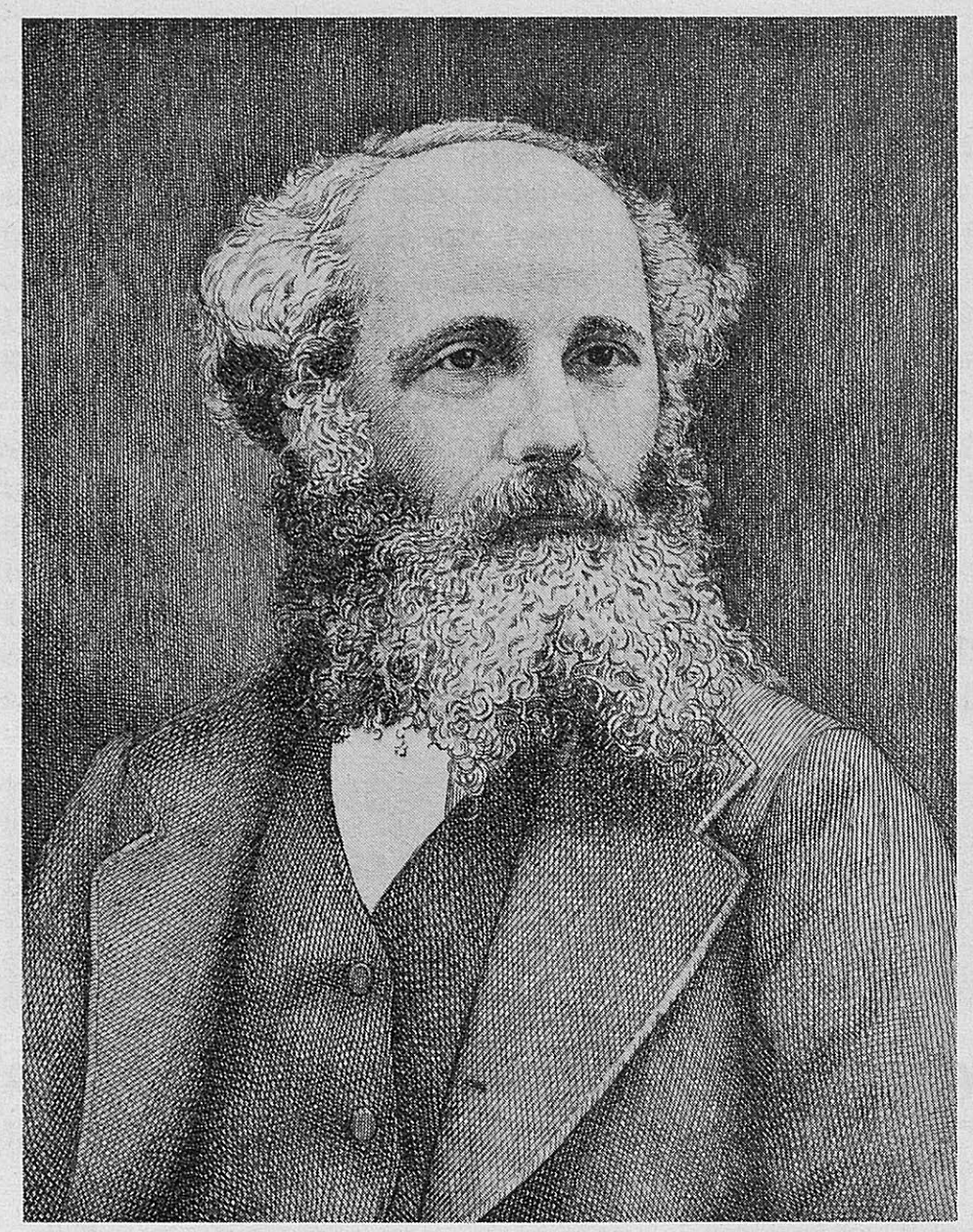
a century of research

by
R. L. SMITH-ROSE
Past President of URSI
Secretary-General of IUCAF

IT MAY WELL BE SAID that the study of the mode of propagation of electromagnetic—or radio—waves started about a century ago: for it was on 8 December, 1864, that Professor James Clerk Maxwell read a paper before the Royal Society in London on *A dynamical theory of the electromagnetic field.* One section of this paper entitled *Electromagnetic theory of light*, set out the classical equations describing the relationship between light waves and the travel of electromagnetic disturbances. The validity of this theory was supported by reference first, to early measurements of the velocity of light (Fizeau 1849, Foucault 1862); and secondly, to the demonstration that the velocity was the same as the number of electrostatic units in one electromagnetic unit of electricity, determined independently by the discharge of a condenser through a galvanometer (Weber and Kohlrausch, 1857).

About a quarter of a century later (1888), Heinrich Hertz suceeded in generating radio waves a few metres in wavelength, and demonstrated their similarity to the shorter waves of light by their reflection and refraction properties. Within the next decade, Guglielmo Marconi and Admiral Sir Henry Jackson in England, and Alexander S. Popov in Russia had started to use these waves for experiments in practical communication. When, in 1901, the first-named demonstrated the transmission of radio signals across the Atlantic Ocean, it became evident that there was a need for scientists to understand and explain the propagation phenomena associated with such transmission round the curved surface of the earth.

It was independently suggested by Oliver Heaviside, in England, and A. E. Kennelly, in the United States of America, that there was in the upper atmosphere a region of electrically conducting air capable of reflecting electric waves: this would prevent the escape of the waves from the atmosphere, and by successive reflections between this region and the earth's surface, they would be guided round the curvature of the earth. Nearly a quarter of a century was to elapse before the existence of such a conducting region was demonstrated in 1925 by E. V. (later Sir Edward) Appleton and M. A. F. Bar-



JAMES CLERK MAXWELL
1831-1879

HEINRICH HERTZ.
1857-1894

nett. They used a frequency change technique to produce interference fringes between the ground waves and those reflected from the region, which was later termed the ionosphere.

Ground wave propagation

In the early days of radio communication, working on the assumption that the waves were propagated by diffraction round the curvature of the earth, every endeavour was made to increase the wavelength of the radiation; and this in turn involved the use of bigger and higher aerial systems to which greater power could be supplied. In this connection it is interesting to record that the British Post Office station at Rugby, England, was the result of a pioneer development and has been in service for nearly forty years, providing worldwide coverage on a frequency of 16 kc/s. It has long been established that on such a frequency the ground wave propagation is assisted by the deflection of the waves in the lowest regions of the ionosphere.

In the first decade of this century, the dependence of ground wave propagation on the electrical properties of the earth's surface was studied theoretically by A. Sommerfeld and his colleagues. Later the prediction made by J. Zenneck in 1907 that the wavefront of radio waves travelling over the earth's surface would be tilted forward in the direction of transmission was confirmed experimentally in 1924 by R. L. Smith-Rose and R. H. Barfield, who used their technique to measure the conductivity of various types of land.

On the communication side using medium wavelengths over short distances, it was found that, since sea water has an electrical conductivity several hundred times that of average land, stronger signals were obtained in transmission over sea than for similar conditions over land. Later investigations showed that the conductivity of the surface influenced the phase, as well as the amplitude, of waves transmitted over it. This results in a sudden change in phase and field strength —and, under certain conditions, of the direction of transmission—when the radio waves cross a coastal boundary between land and sea water. This field of research has been aided by direct laboratory measurements of the electrical properties of samples of the earth's surface; and in recent years, the study of ground wave propagation has advanced with the technique of radio to increasingly higher frequencies.

The ionosphere and high frequency propagation

Almost concurrently with the demonstration, referred to above, of the existence of the ionosphere by means of a frequency changing technique, G. Breit and M. A. Tuve in the United States used a pulse method to measure directly the time interval between the arrival of waves transmitted along the ground and those which arrived later after travelling up to the ionosphere and down to the receiving station. Shortly after their original experiments, Appleton and his co-workers showed that by increasing the frequency, the radio waves could penetrate the lower (or E) region at about 100 km, and be

reflected from a higher (or *F*) region, which was at a height of some 400 or 500 km.

These pioneer experiments provided first, the explanation of the manner in which short (high frequency) radio waves can travel right round the earth by successive reflections between the earth and the upper atmosphere; and secondly, the basis of the subsequent exploration of the physical characteristics of the upper atmosphere which has been in progress for the past forty years. It soon became evident that the operation of high frequency communication circuits was greatly dependent upon solar activity and the emmission of ultraviolet light as the basic ionizing influence on the earth's atmosphere. At times of high sunspot activity, the ionization becomes very intense; and radio waves at various frequencies up to 30 Mc/s—and sometimes over 40—are efficiently reflected from the ionosphere at the oblique incidence conditions relevant to long-distance propagation. At other times, the activity on the sun's surface passes through a minimum phase, and the corresponding frequencies for effective propagation may decrease to a third or a quarter of the above maximum values.

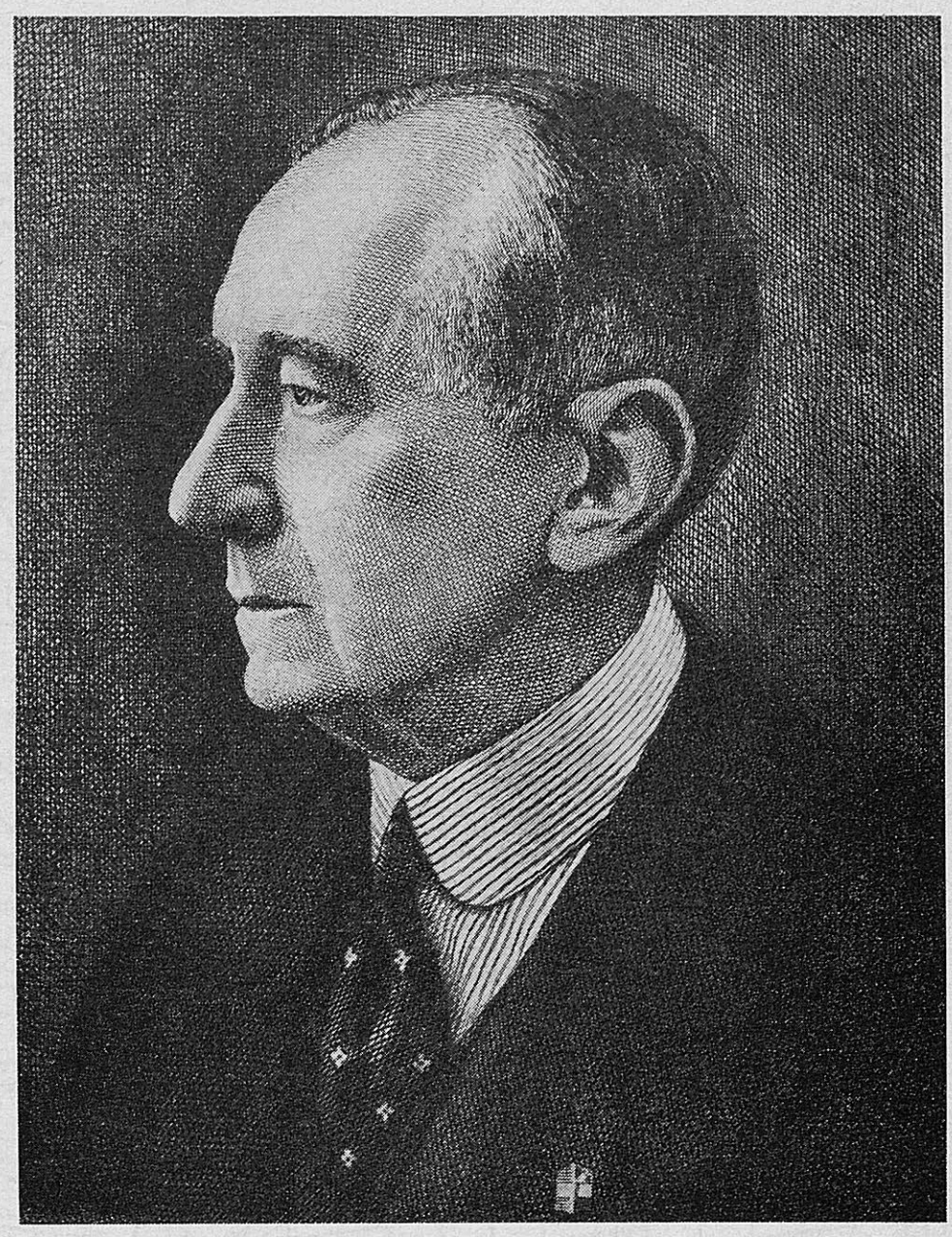
It was during the International Geophysical Year (IGY) of 1957-58, that the solar activity was last at a maximum; and was indeed greater than it had been since regular visual observations of the number and magnitude of sunspots were begun some 200 years earlier. At the time of writing (December 1964), we are about half-way through the two-year period of the International Quiet Sun epoch (IQSY), and the solar activity has already reached a very low value, with a corresponding reduction in the limiting frequencies which can be used for long distance communication involving propagation by way of the ionosphere. In passing, it is interesting to recall that, following earlier investigations of the upper atmosphere by means of rockets, it was during the IGY that the first instrumented earth satellites were launched; and, among other investigations, these have considerably increased our knowledge of the electrical conditions in the ionosphere.

Earth satellites and the ionosphere

More recently, in 1962, the Canadian satellite *Alouette* was launched into an elliptical orbit round the earth at a height of approximately 1000 km. With its ionospheric sounder having a frequency range from 0.45 to nearly 12 Mc/s, this satellite has, for the past two years, been recording the characteristics of the ionosphere from above the level of maximum ionization which is at a height of 400 or 500 km. In 1964, another satellite designated as *Explorer 20* was launched by the United States to sound the ionosphere from above on a series of frequencies ranging from 1.5 to 7.22 Mc/s. Both these satellites provide transmissions on command from a ground station; and are equipped with beacon transmitters for continuous identification and tracking purposes.

Propagation through the lower atmosphere (troposphere)

While the engineers responsible for developing world-wide communications were busy exploiting the high

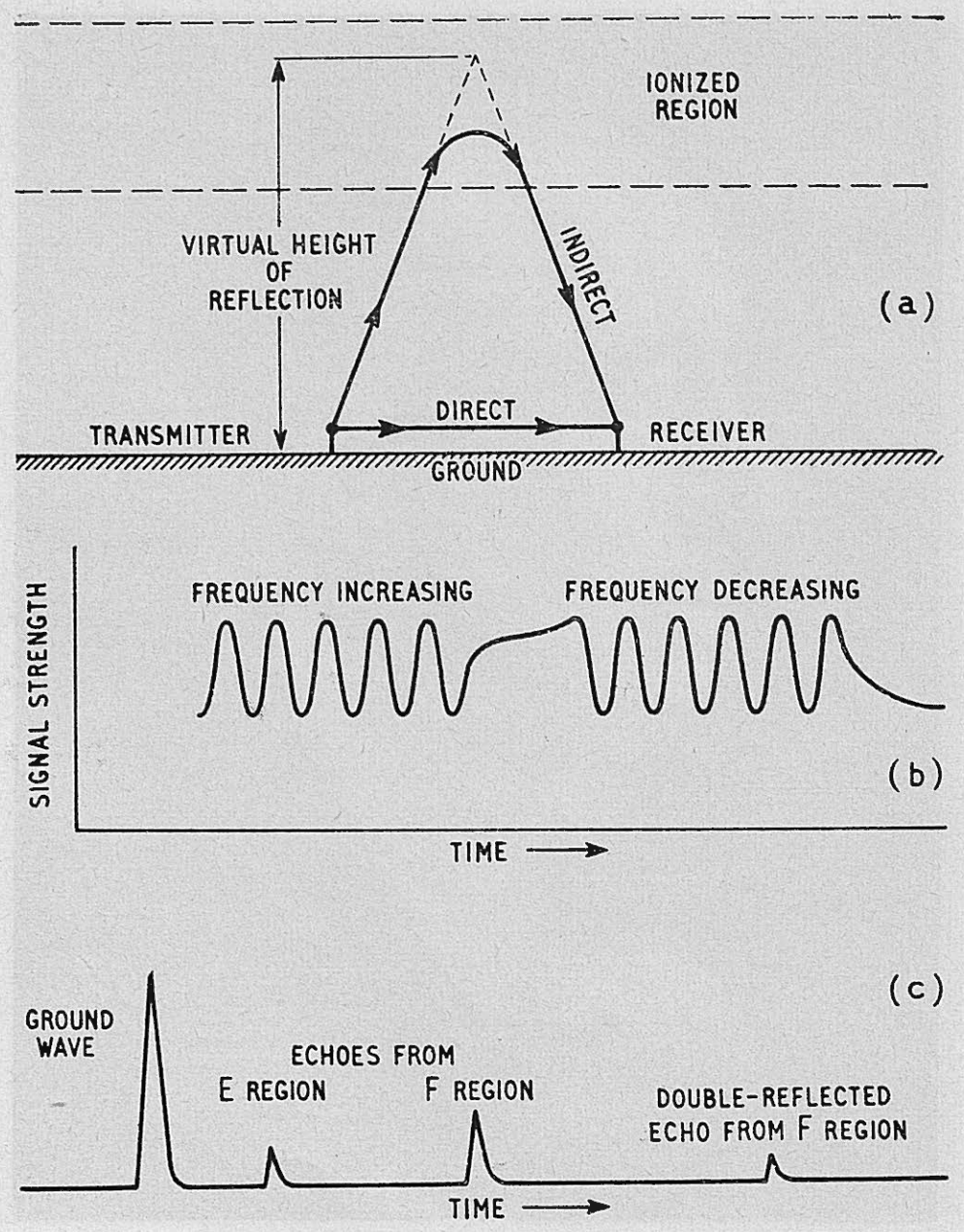


GUGLIELMO MARCONI
1874-1937

frequency or short wave portion of the spectrum, others were turning their attention to the possibilities of still shorter waves. Over seventy years ago (1893), Lord Rayleigh presented a theoretical explanation of the observed scintillation of stars based upon the refraction of light waves in traversing the earth's atmosphere. And it is over half a century since J. A. (later Sir Ambrose) Fleming and others examined the corresponding problem of the bending of radio waves due to the vertical gradient of the refractive index of the atmosphere. Later it became clear that the water vapour content of the atmosphere was a major factor in determining the refractive index of the air at very high radio frequencies.

Such theoretical investigations were soon confirmed, usually by independent experimental work. For example in 1926, French engineers conducted experiments between southern France and the island of Corsica; and soon established communication on a wavelength of five metres over this sea path of some 230 km. A few years later, similar experiments were conducted across the Channel between England and France on a wavelength of 17 cm: while Marconi, turning his attention to the possibilities of the shorter wavelengths—one metre and below—obtained communication between Rome and Sardinia, a distance of about 270 km on a wavelength of 50 cm (frequency 600 Mc/s).

In the decade 1930-1940, the development of techniques for both the transmission and reception of radio waves at frequencies between 30 and 10 000 Mc/s (wavelengths 10 m down to 3 cm) greatly stimulated research



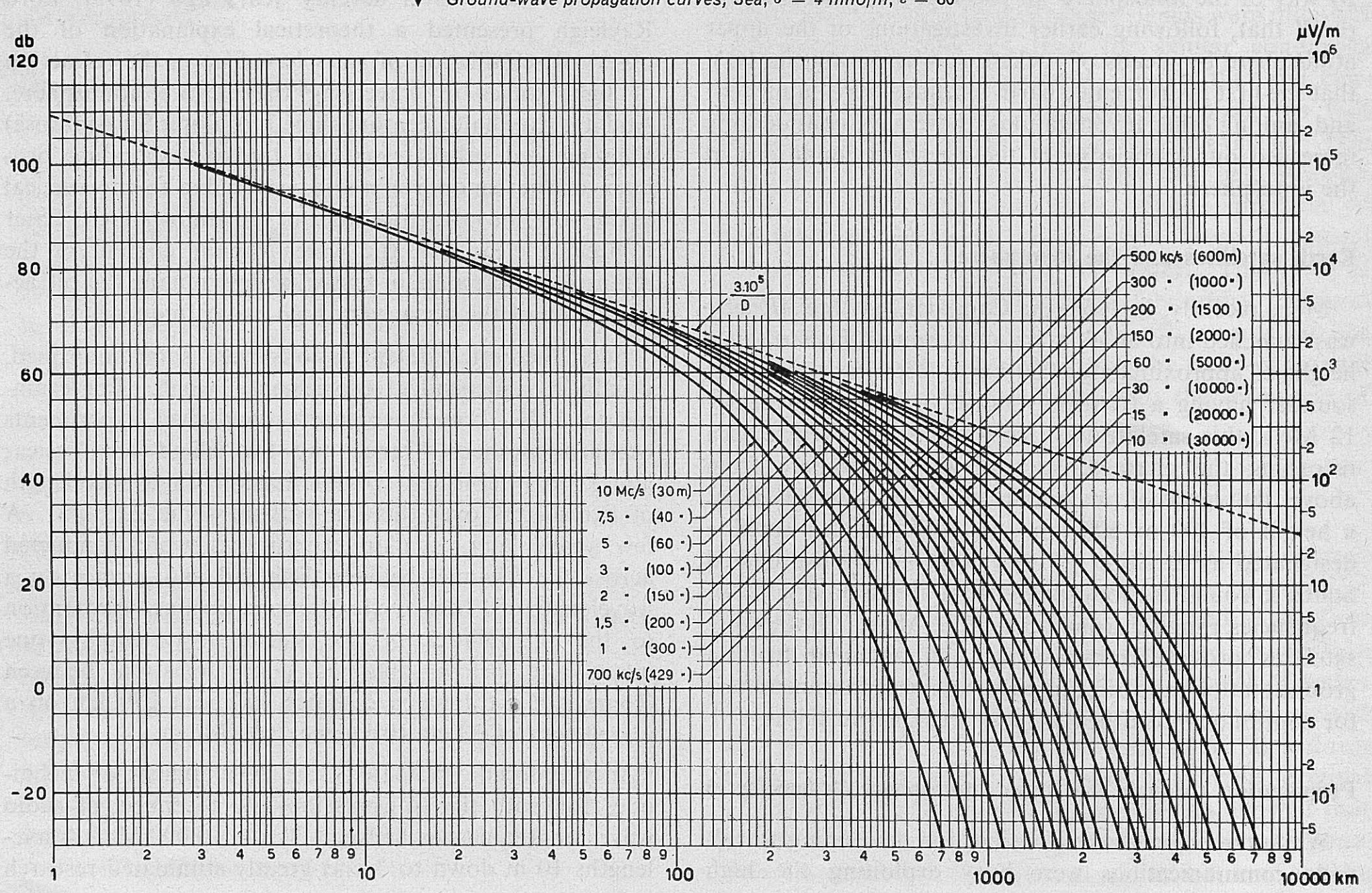
▲ (a) *Paths of direct and indirect waves from transmitter to receiver; and the measured—or virtual height of reflection of the indirect wave.*
(b) *Interference fringes in received signal due to ground and ionospheric waves, as the frequency of the transmitter is varied over a small range. The ratio of the number of signal maxima to the change of frequency gives the difference in time of arrival of the two signals, and so the height of reflection of the indirect wave.*
(c) *Echoes of transmitted pulses after reflection from the lower* (E) *and upper* (F) *ionized regions: and also of an echo of a pulse which has been twice reflected from* F *with an intermediate reflection at the ground.*

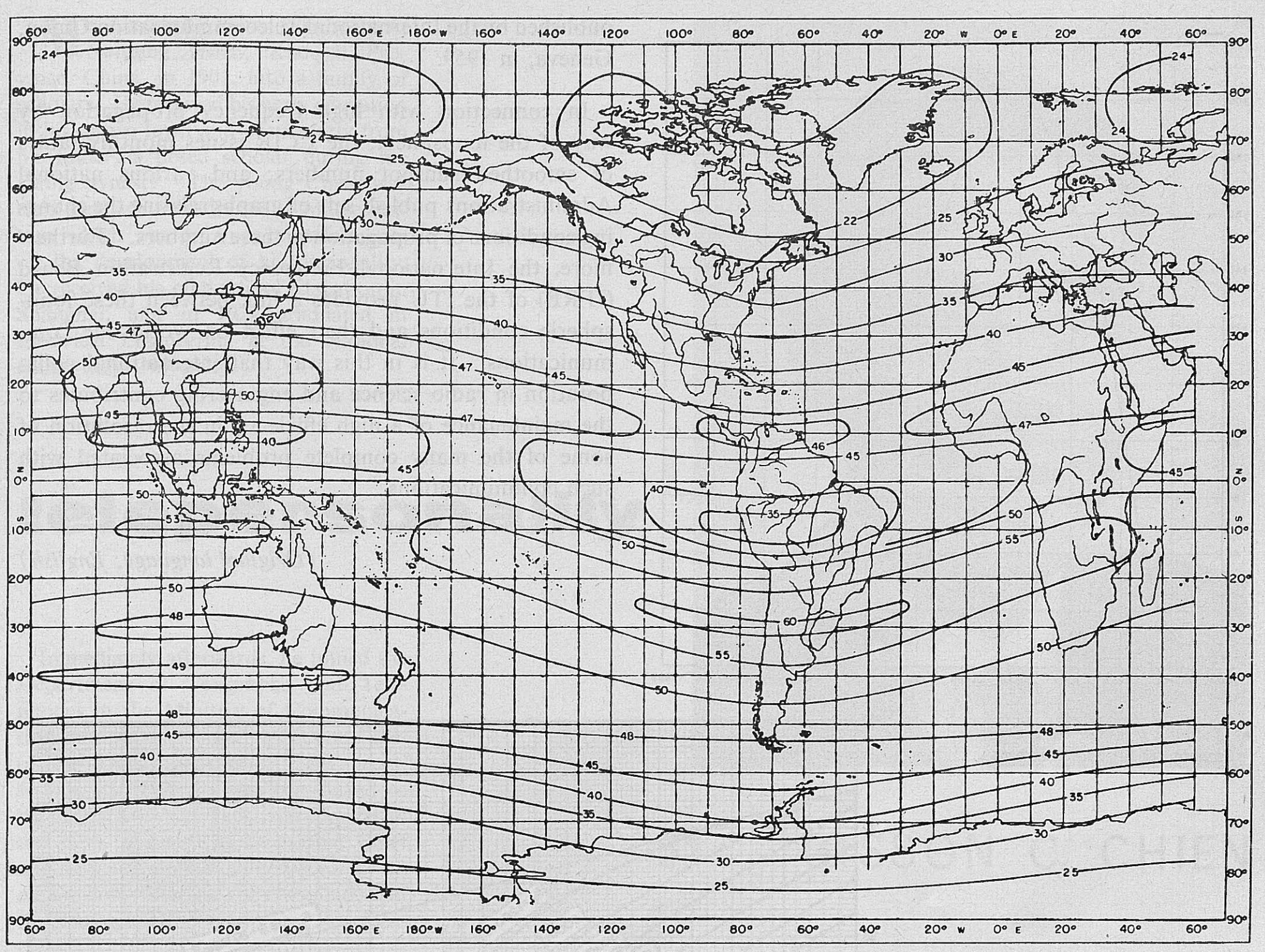
on the propagation of waves over the earth's surface and through the lower atmosphere. Continuing up to the present day, extensive experimental investigations have been conducted in all parts of the world with the view of understanding the effect of meteorological conditions upon the propagation of these very short radio waves. In order to assist the meteorologist to present a more detailed and precise description of the atmosphere, the radio scientist has applied both radar and radio sounding techniques directly to the study of the vertical structure of the atmosphere up to a height of ten kilometres or more. Among the recently developed instruments for this purpose is the microwave refractometer which, when carried in a balloon or aircraft, provides a direct measurement of the refractive index of the atmosphere. By combining this with a simultaneous study of radio waves transmitted through the same part of the atmosphere, recent research has demonstrated how complex are the features of tropospheric propagation.

Radio and navigational aids

While many ingenious techniques have been devised to use radio waves for the navigation of ships and aircraft and for surveying on land, the scope of these has

▼ *Ground-wave propagation curves; Sea,* $\sigma = 4$ *mho/m,* $\varepsilon = 80$





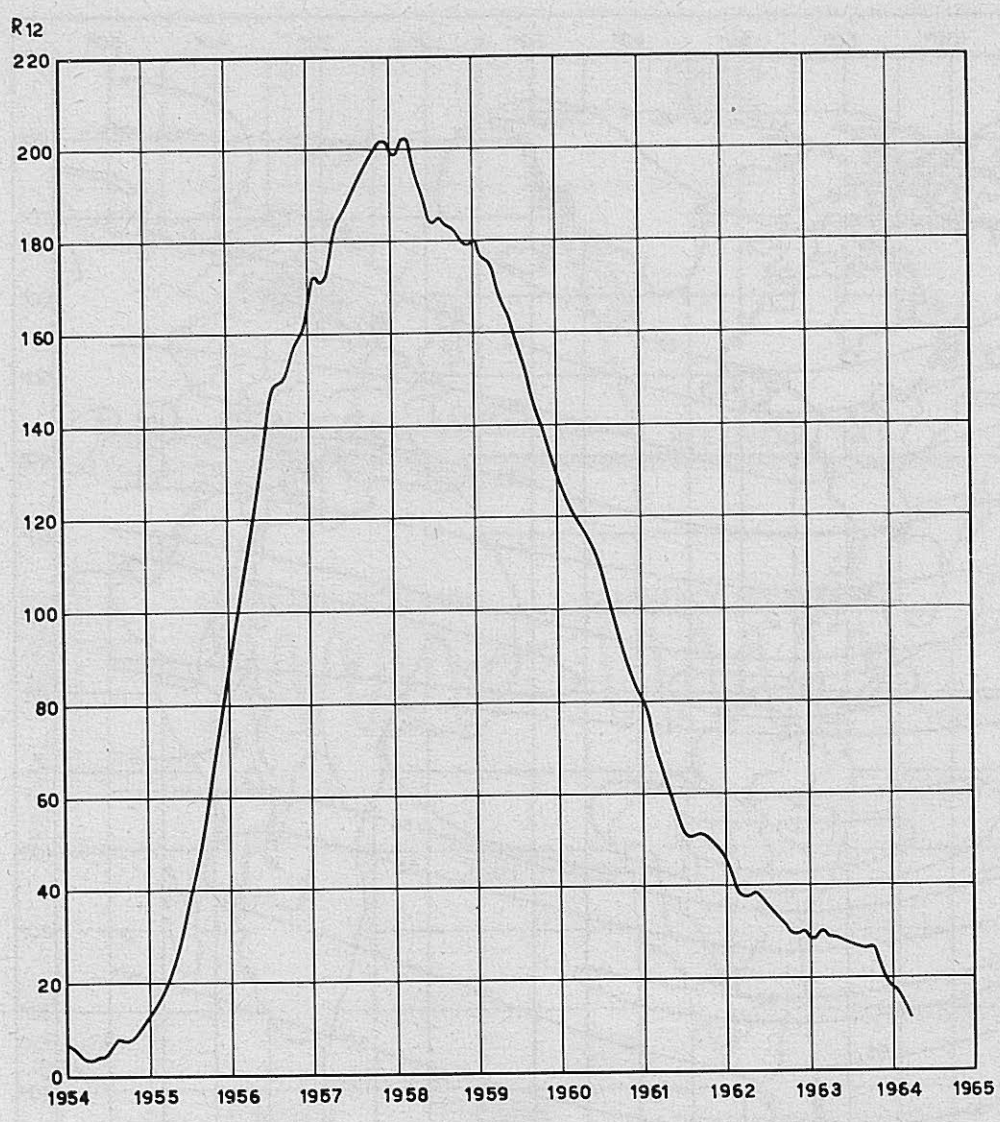
F2 4000 MUF exceeded during 1% of hours — June solstice; sunspot maximum

usually been limited by the vagaries of the propagation of the waves used, and the dependence of this propagation upon the changing conditions in the upper and lower atmosphere (ionosphere and troposphere). In recent years however, there has been a reversion to the use of very low frequency waves—30 kc/s and below—since these usually provide more stable propagation, the effects of which vary much less and more slowly than is the case at higher frequencies. An added advantage is that the lower the frequency of the waves the greater is the depth of penetration below the surface of the sea; thus rendering them suitable for submarine communication and navigation.

International collaboration

From the earliest days of the scientific study of radio wave propagation it has been clear that co-operation on an international scale would be essential in the pursuit of research under various conditions in different parts of the world. The existence and activities of the International Scientific Radio Union (URSI), and the International Radio Consultative Committee (CCIR) have for many years past provided a very satisfactory basis for organizing, co-ordinating and discussing research on wave propagation and the application of the results to the practice of radio communication.

At its XIVth General Assembly in Tokyo in 1963, URSI celebrated its Silver Jubilee and the study of the scientific problems of radio over the previous fifty years. The CCIR is a somewhat younger organization; but following its fourth Plenary Assembly in Bucharest in 1937, a special Committee on radio wave propagation met in London in November of the same year. By co-ordinating the then existing state of knowledge of the subject, this committee prepared a report containing 64 sets of graphs summarizing, in a form suitable for engineering application, propagation curves for medium frequency ground and sky wave conditions, for high frequency ionospheric conditions, and for ultra high frequencies transmitted over land and sea. The continuous study and revision of this material by the CCIR has culminated so far as ground wave conditions are concerned in an *Atlas of ground wave propagation curves for frequencies between 30 and 10 000 Mc/s*

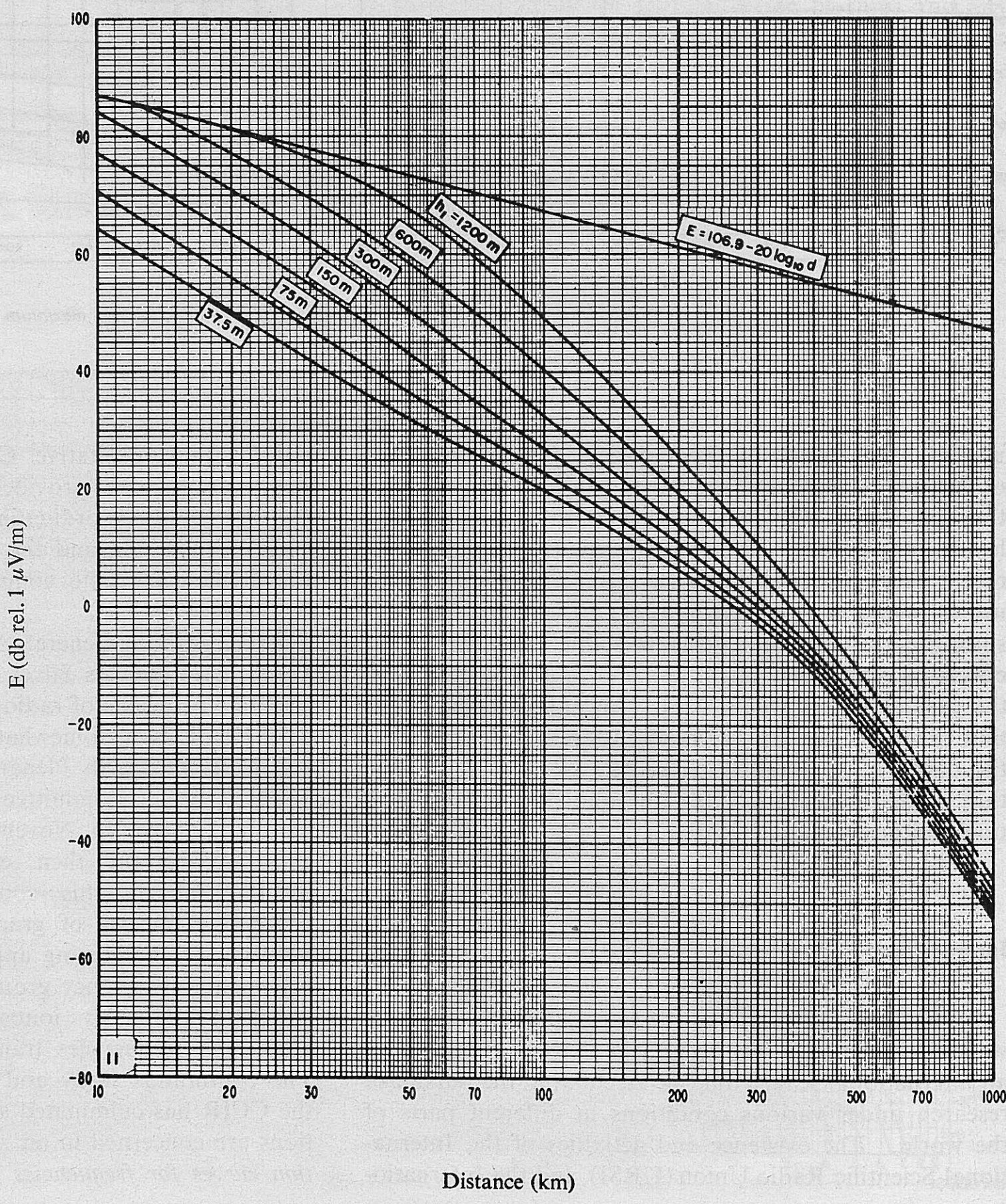


▲ *Running average over twelve months of sunspot numbers*

published by the International Telecommunication Union, Geneva, in 1959.

In connection with high frequency propagation by way of the ionosphere, the CCIR issues monthly tables of smoothed sunspot numbers; and various national Administrations publish sets of graphs relating the changing conditions of propagation to these numbers. Furthermore, the International Frequency Registration Board (IFRB) of the ITU provides a link between these ionospheric conditions and their effect on worldwide communications. It is in this way that international collaboration in radio science and engineering contributes to the maintenance of a high efficiency in the resolution of some of the many complete problems associated with such communications.

(Original language: English)



Values of E (50.50) for a sub-tropical (maritime) climate

Frequency: 40-250 Mc/s
h_1: as indicated on the curves
h_2: 10 m ▶

telepersonality

51 – GISSON C. CHIEN

MR. GISSON C. CHIEN WAS BORN at Nantung Hsien, Kiangsu Province, China, in 1901, into a family of scholars. He received his early education in his native town and particularly from his father, a noted scholar during the Ching dynasty. The young Chien was thus steeped in traditional Chinese culture which was an important influence on the development of his personality. He received his high school education in Shanghai, and in 1924 graduated in Electrical Engineering at the National Chiao-tung University.

Immediately afterwards, he joined the Department of Telegraphs and Telephones in the Ministry of Communications and was promoted to Section Chief of the Department after eight years' service. In 1933 he was transferred to the Department of Technical Experts in the same Ministry as Divisional Chief and was also appointed convenor of an *ad hoc* committee on the compilation of telecommunication equipment specifications.

In 1935, he went to the United Kingdom, where he spent eight months examining the equipment to be used for building a long-distance telephone network covering nine Chinese provinces. On his way back to China, he spent about three months in Germany and visited the United States of America.

Upon his return from abroad, he set up a modern laboratory for testing telecommunication materials in the Department of Technical Experts of the Ministry.

In 1938, when the Sino-Japanese war broke out, he was engaged in the work of planning the north-west and south-west long-distance telephone network as well as the air defence communication network. In recognition of his outstanding service, he was appointed Deputy Director of the Department of Telegraphs and Telephones of the Ministry of Communications in 1942. In 1943, the Directorate General of Telecommunications was established and the Department of Telegraphs and Telephones was reorganized as the Department of Posts and Telecommunications. He was appointed Deputy Director-General of the new organization and, in 1947, was made Director-General after the resignation of his predecessor.

After the Second World War, he devoted himself to the tremendous work of repairing the six main lines which had been seriously damaged during hostilities.

In 1950, he was called upon by his Government to serve as Vice-Minister of Communications concurrently with his duties as Director-General of Telecommunications. He helped to prepare and implement the 4-year development plans, of which telecommunications were an important feature.

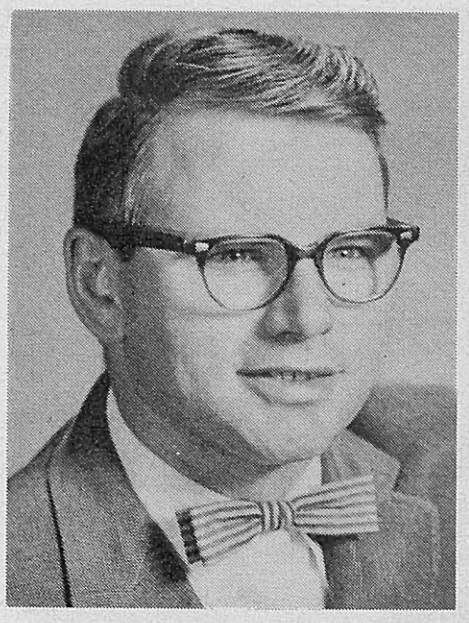
In 1960, however, he resigned his post as Vice-Minister for health reasons, and devoted himself full time to the development of telecommunication services in his country.

Mr. Chien has also been most active in international affairs. As Head of the Chinese Delegation, he attended the High-Frequency Broadcasting Conference held in Mexico City in 1948, where he was elected Vice-Chairman of Committee 7. Since 1956, he has attended eight sessions of the Administrative Council of the Union. He sponsored a project to establish a Telecommunications and Electronics Research and Training Centre in Taiwan. This was the first Special Fund project of the ITU, after it had been approved by the United Nations early in 1961, and has been carried out very satisfactorily.

In spite of his onerous official duties, Mr. Chien takes an active part in social activities. He served as Executive Secretary of the Chinese Institute of Engineers for several years, and in 1964 was elected Chairman of the Chinese Institute of Electrical Engineering; he is also Chairman of the Chinese National Committee of the International Scientific Radio Union (URSI) and an elected Member of the National Assembly of the Republic of China. Professor at the Electronics Institute of the National Chiao-tung University, he is the author of three books in Chinese: *Telecommunications in Europe and in America*, *Material management* and *General treatise on China's telecommunications*.

His personality radiates kindness and warmth towards his fellow men, while disciplining himself to lead a simple frugal life. *Jen* (benevolence) and *Yi* (righteousness) are the principles by which he has always been guided in his professional career and in his private life.

(Original language: English)



THE USE OF TOPSIDE SOUNDERS IN IONOSPHERIC RESEARCH

by Kenneth DAVIES

National Bureau of Standards, United States of America

RADIO SOUNDINGS OF THE ionosphere have been made with ground-based sounders for the last thirty years or so and have led to a considerable knowledge concerning the electron density distribution in the ionosphere [1], largely through the development of the swept- or stepped-frequency ionosonde. Information concerning the temporal and geographical variations of the maximum electron densities and the heights of the various layers has contributed to the development of short-wave radio communications.

Radio soundings of the ionosphere with ground-based equipment suffer from a number of disadvantages:

1. The sounding stations are fixed and, for extensive geographical coverage, a large number of stations are required
2. Relatively high transmitter output (peak) powers are required because of the absorption of the signals in the *D* region of the ionosphere. This requires relatively large antenna systems with adequate gain and a sufficient source of electrical power
3. Because of the nature of the soundings, it is not possible to determine uniquely the electron density distribution in the " valleys " between layers [2]. It is also impossible to obtain information on the distribution above the level of maximum electron density except by the very sophisticated technique of incoherent scatter [3].

Advantages of sounding from satellites

Satellites have some unique advantages in ionospheric studies, some of which are listed below:

(a) a large region of the earth can be sounded in a relatively short period;

(b) the soundings are all made with the same equipment so that observed differences can be ascribed to the ionosphere rather than to equipmental factors;

(c) low transmitter powers are required because the reflected radio waves do not suffer absorption in the *D* region, unless they are reflected from the ground;

(d) the power from the sounder is obtained directly from the sun *via* solar cells which, in turn, charge up the storage batteries;

Table 1

Data on Alouette topside sounder

frequency range	0.5 to 12 Mc/s
repetition rate	67 per second
sweep duration	18 seconds
pulse duration	100 μ sec
power input	$\simeq$ 200 watts
peak power output	10 watts
antennas	dipoles
	150 feet (22.9 m)
	75 feet (45.8 m)
weight	145 kg
diameter	1.1 metres
telemetry	136 Mc/s
launched	*29 September, 1962*
orbit:	
as of 17 October, 1962	
inclination	80.463°
perigee	996.38 km
apogee	1031.05 km
velocity at perigee	26.5 km/hour
velocity at apogee	26.4 km/hour

(e) once the sounder is in orbit, no further maintenance is required;

(f) because the sounder is embedded in the magneto-ionic medium, it is possible to observe certain phenomena which cannot be detected with ground based sounders.

Of course some of these advantages are accompanied by certain drawbacks. For example, because of the continuous motion of the satellite it is not easy to distinguish between geographical variations and temporal changes in the ionosphere. Furthermore, if the solar cells are damaged by excessive radiation or if an electronic malfunction occurs, it is almost impossible to take corrective action, short of installing a duplicate system.

Two methods of pulse sounding can be used in satellite studies; namely, the fixed frequency and sweep frequency pulse techniques. Each of these methods has certain advantages. For instance, the advantage of sweeping the frequency is that the resulting ionogram is easier to interpret and that it is easier to convert the ionogram

data into an electron density profile. Because of the movement of the satellite, however, the resulting profile is *averaged* over a considerable geographical area. A disadvantage of this technique is that the equipment characteristics (e.g., antenna gain, transmitter output, etc.) have to be compromised over the frequency band, so that maximum advantage cannot be taken of tuned circuitry at the transmitter output and receiver input. The fixed frequency technique takes advantage of tuned circuitry, but the resulting data (records) are more difficult to interpret. However, the soundings can be carried out at short intervals so that geographical continuity is easier to achieve. The use of a number of fixed frequencies on the satellite can give information on the electron density distribution $N(h)$ if suitable models are fitted to the available data—for example, one having an exponential variation of electron density with altitude. The fixed frequency technique is particularly valuable in studying ionospheric irregularities because the latter have a limited geographical extent. Thus, the optimum arrangement would be a combination of both types of sounder in one satellite.

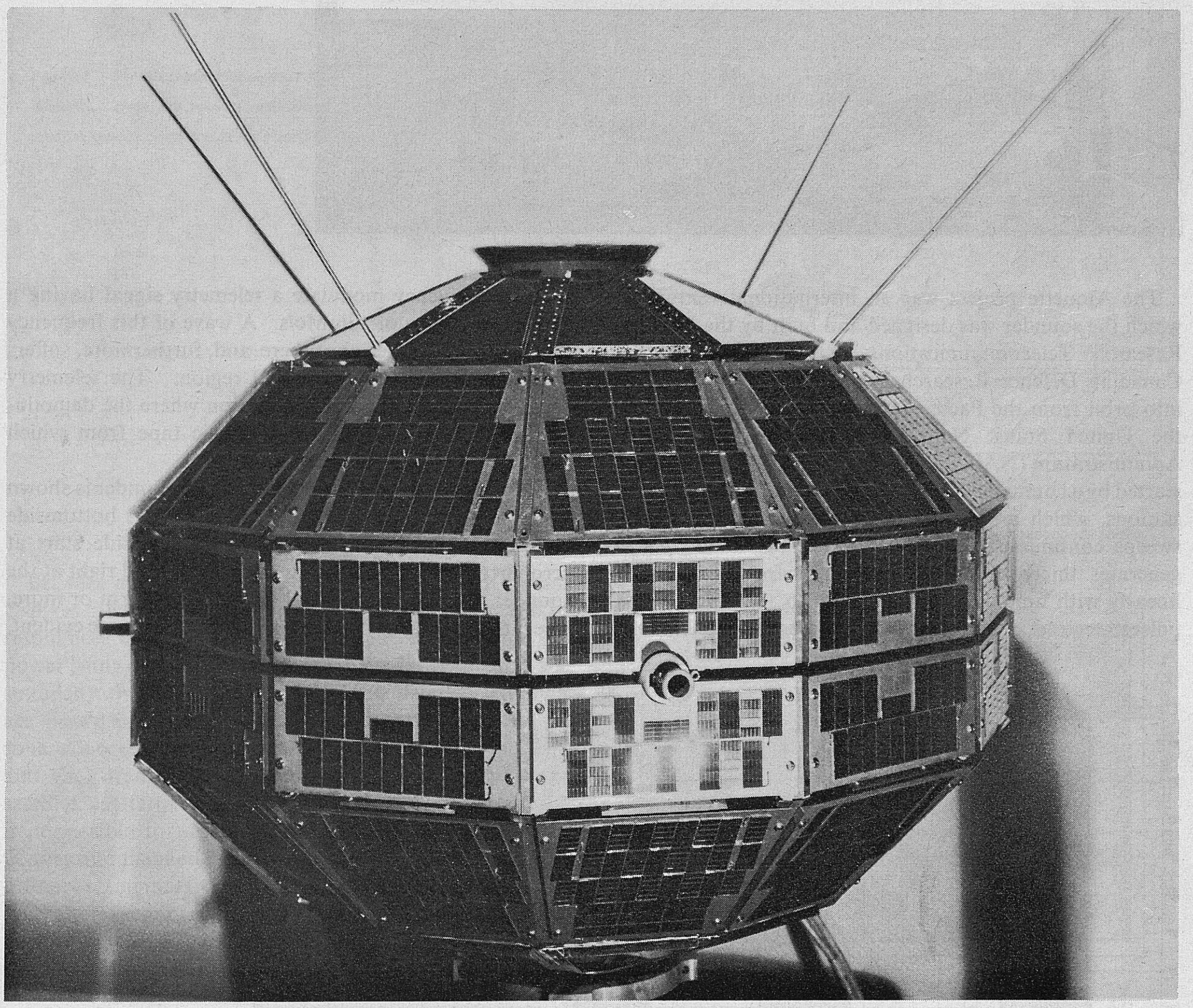


Figure 1 — Close-up picture showing the physical appearance of Alouette. The surface is covered with solar cells. The four antennas shown here are for elementary purposes.

The Alouette sounder

The *Alouette* sounder [4], which was launched at 0605 universal time on 29 September, 1962, is a prolific producer of sweep-frequency ionograms, about 5000 per week. Pictures of the satellite are shown in figures 1 and 2. The sounder itself is an oblate spheroid, 145 kilograms in weight and 110 centimetres in diameter. The power for the electronic systems is supplied by a combination of 6500 solar cells, each of size 1 cm by 2 cm, which cover the surface of the sounder and which charge four nickel-cadmium storage batteries. The solar cells supply 18 watts of power, and are so arranged that the over-all output power is relatively independent of the orientation of the sounder relative to the sun. Some relevant data on the sounder are given in table 1.

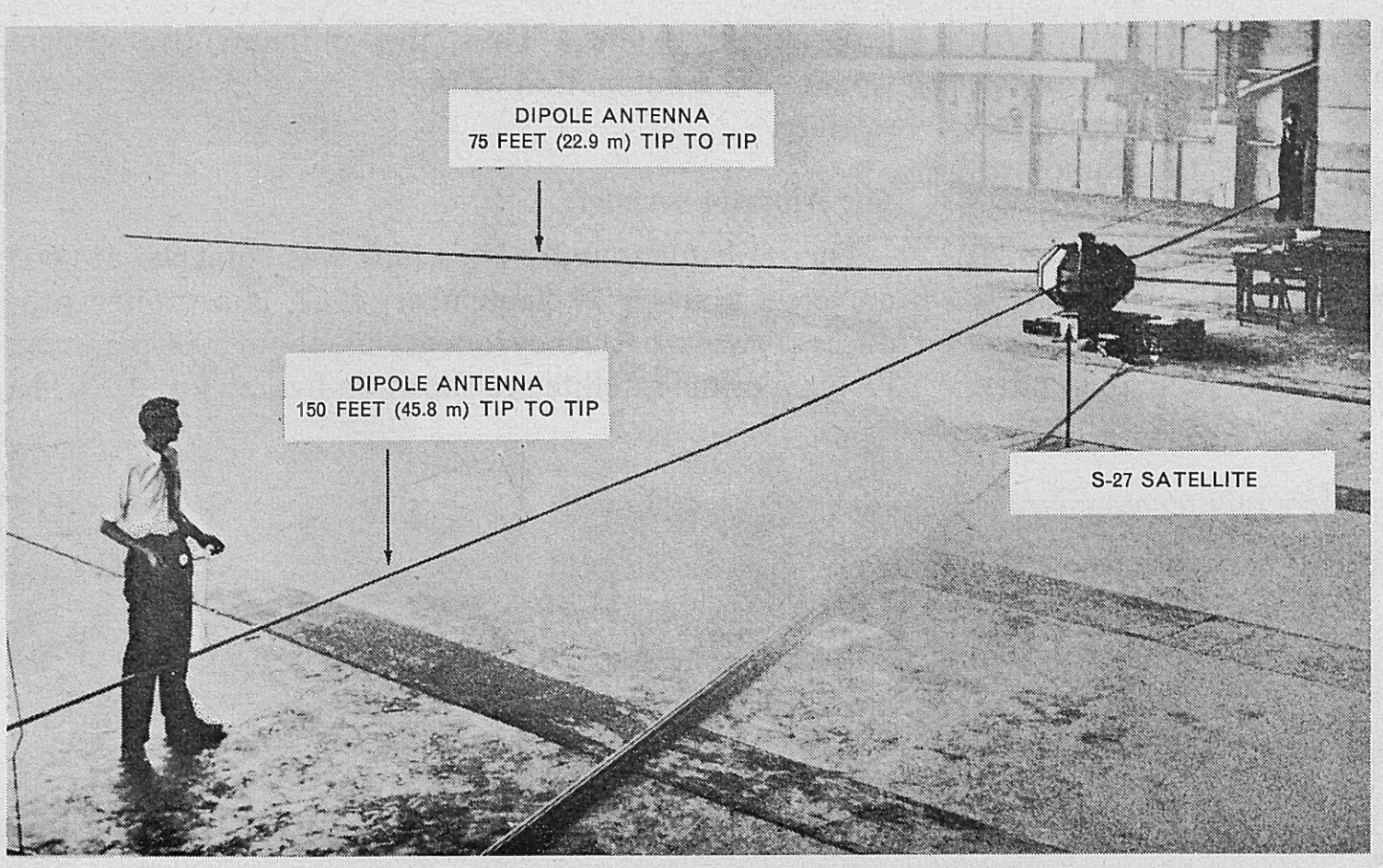


Figure 2 — View of Alouette showing the relative sizes of the transmit-receive antennas.

The Alouette project was an international venture in which the sounder was designed and built by the Defence Research Telecommunications Establishment of the Canadian Defence Research Board and it was launched into orbit from the Pacific Missile Range, California, by the United States National Aeronautics and Space Administration (NASA). The operation of the sounder is started by a command from any one of a number of ground stations, which are shown in figure 3. Once started, it sweeps continuously for ten minutes, in which time it generates thirty sweeps in which the frequency varies linearly with time over the range 0.4 to 11.5 Mc/s. The pulses received, after reflection from the ionosphere, are used to frequency modulate a telemetry signal having a carrier frequency of 136 Mc/s. A wave of this frequency easily penetrates the ionosphere and, furthermore, suffers very little absorption in the *D* region. The telemetry signal is received at a ground station where the demodulated signal is recorded on magnetic tape from which ionogram films can be made later.

A sample ionogram from the Alouette sounder is shown in figure 4. In contrast to the more familiar bottomside ionograms [1], the echo traces for the topside start at zero virtual depth, that is, signals are reflected right at the sounder instead of at virtual heights of 100 km or more. The familiar ordinary and extraordinary traces are evident.

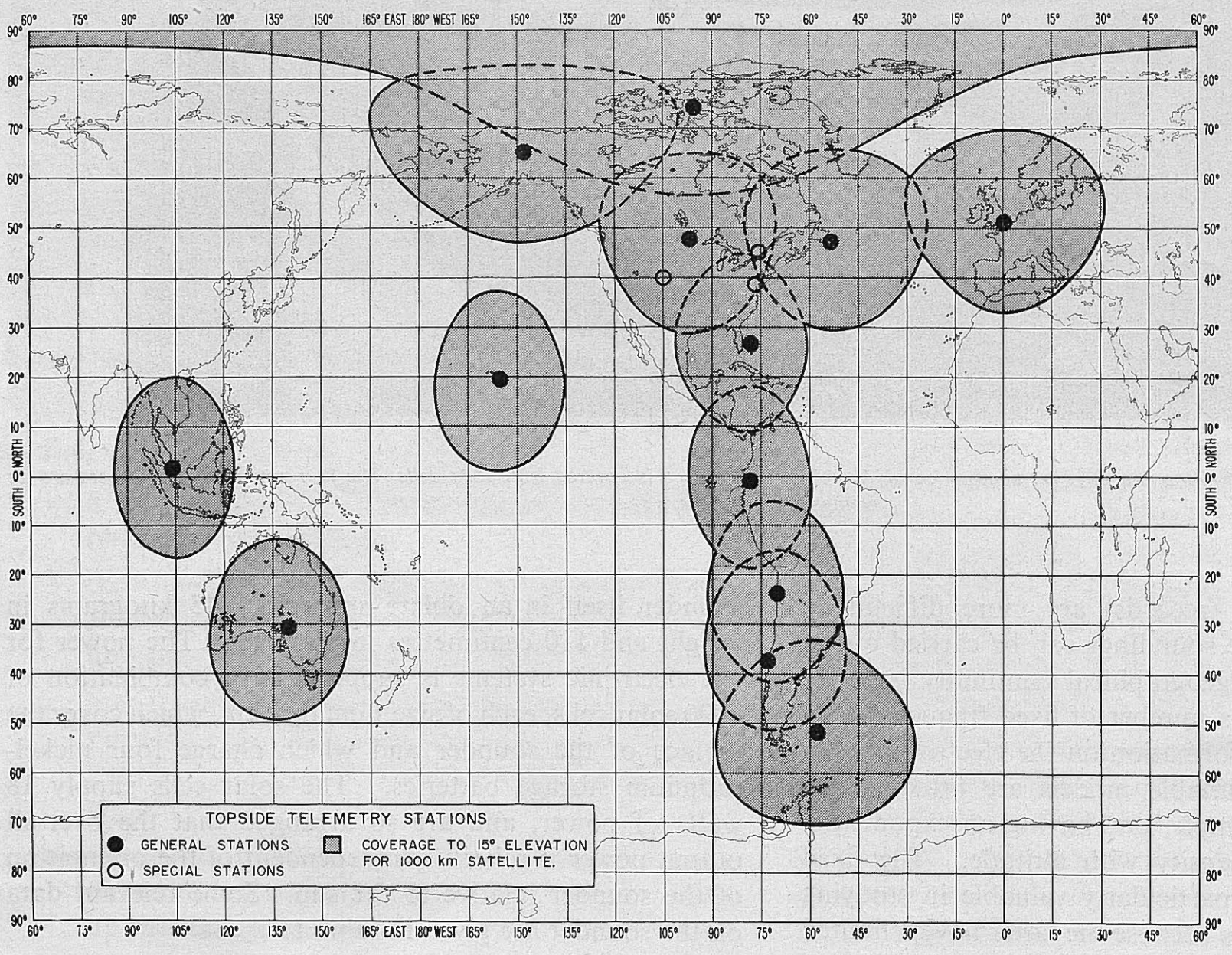


Figure 3 — Map showing the geographical distribution of ground stations for the topside sounding programme, March 1964.

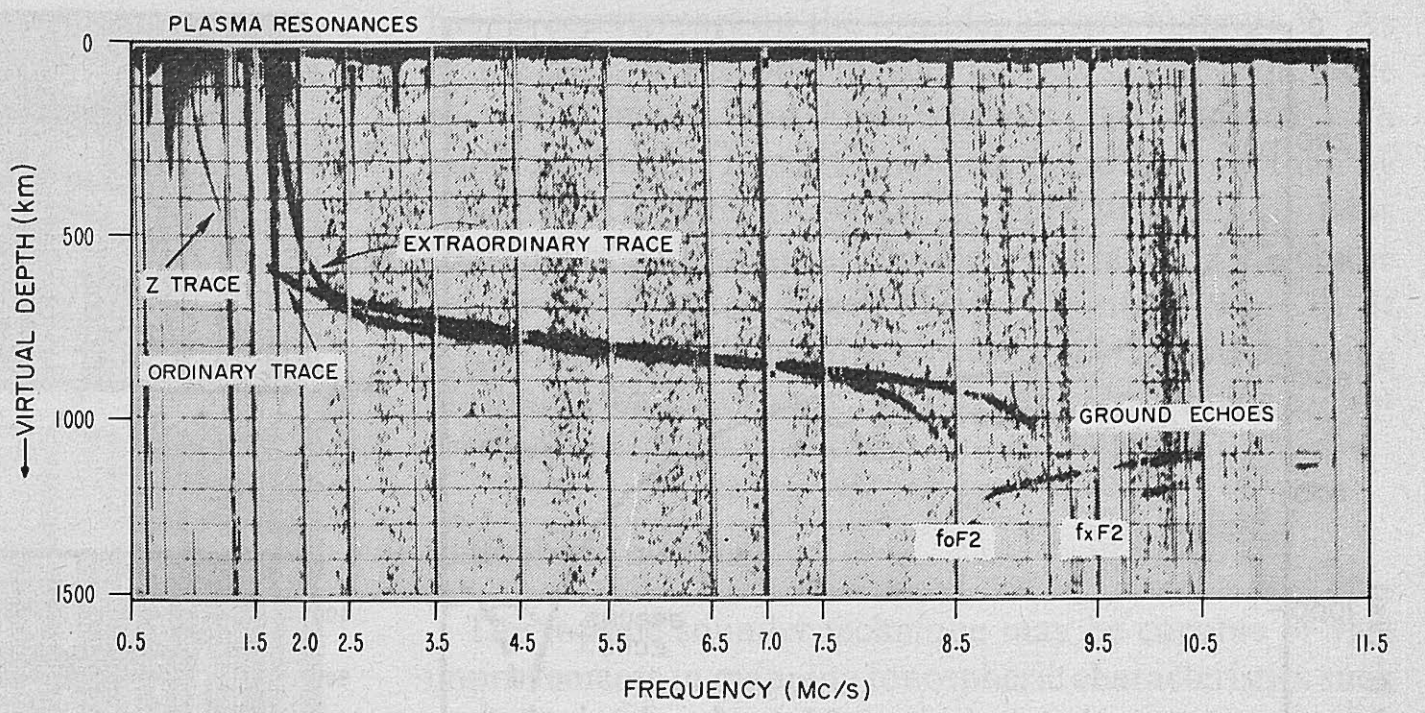


Figure 4 — Sample topside ionogram from Alouette. Note the plasma resonances and the echoes from the earth's surface. ▶

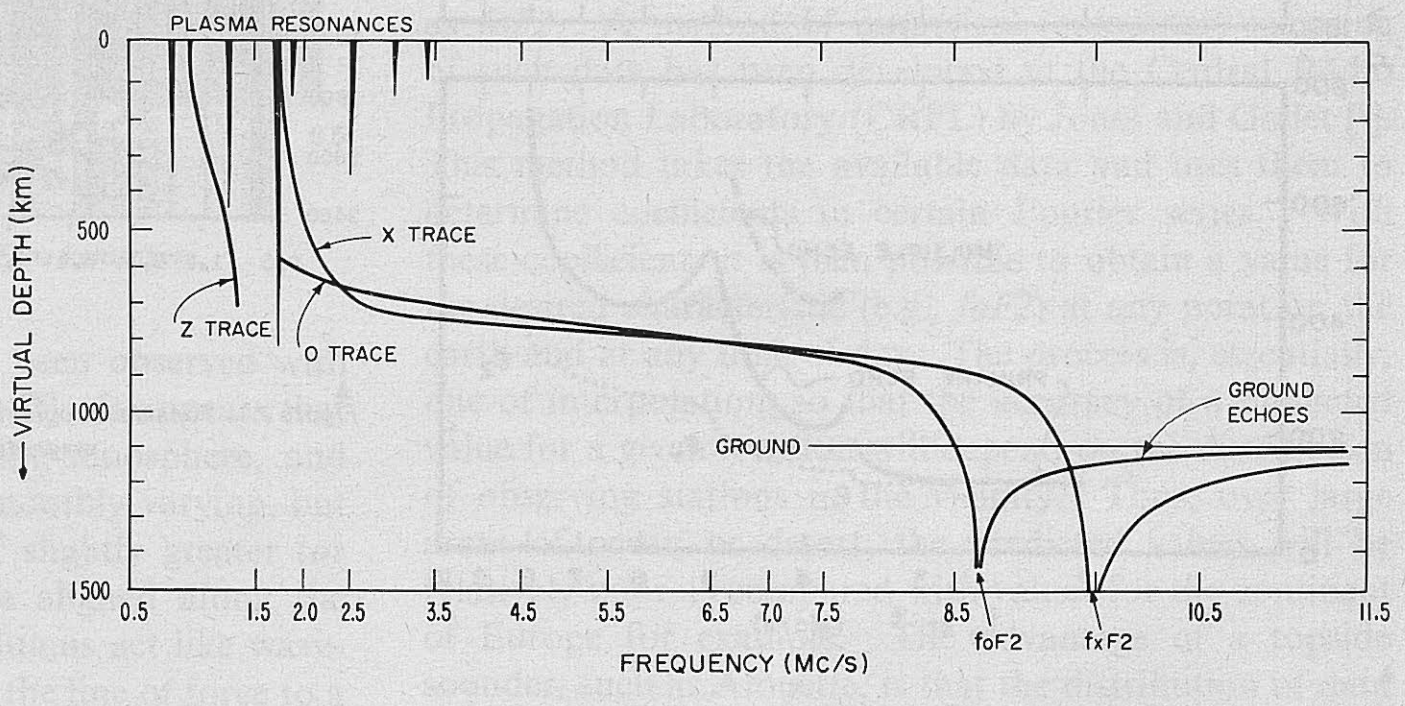


Figure 5 (below) — *Topside ionograms with plasma resonance spikes.*

▼

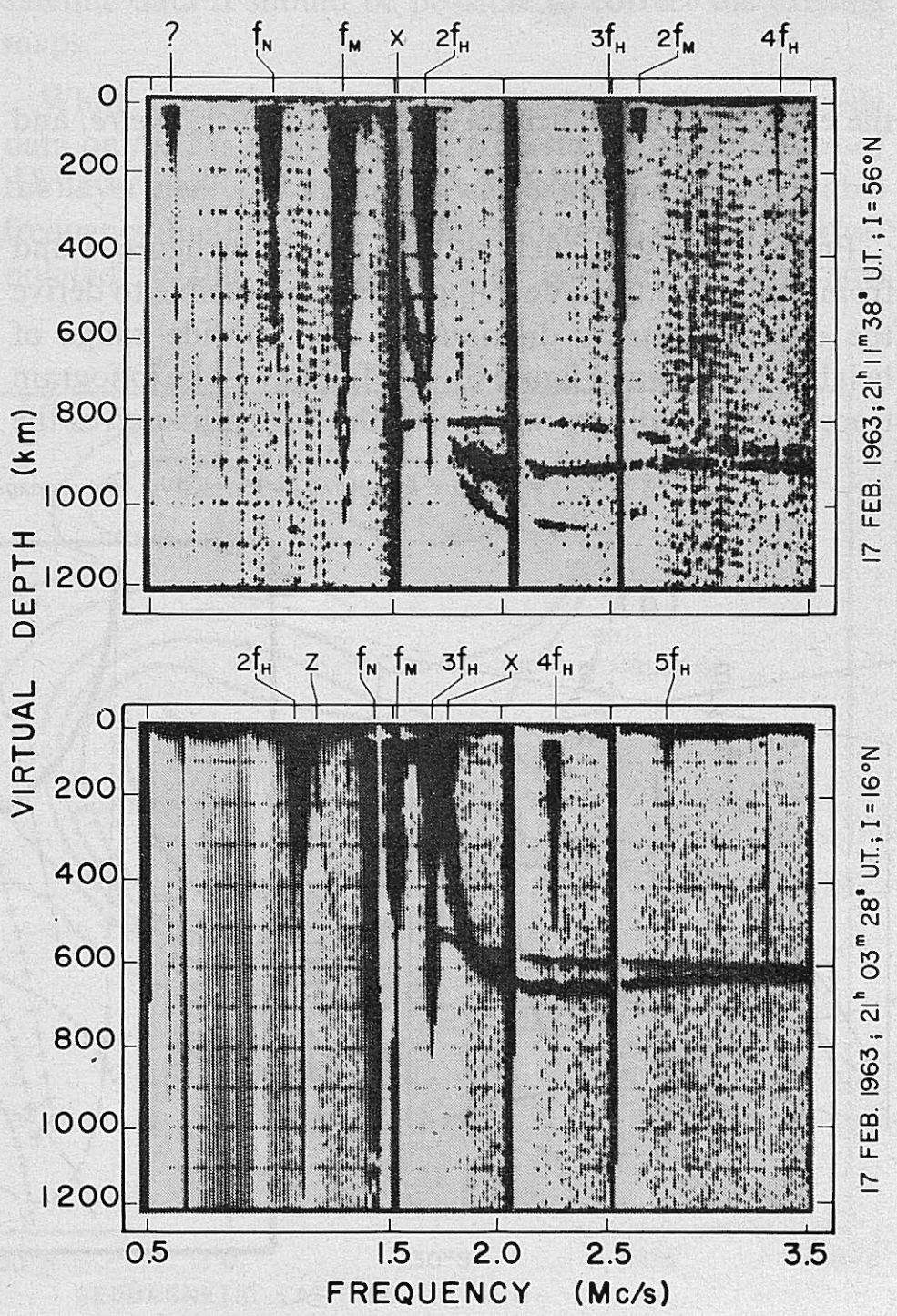
Between about 1.0 Mc/s and 2.0 Mc/s there are several " spikes " which are called resonances. These are due to resonances of the electrons just outside the antenna, the power being confined to the space immediately around the sounder rather than radiated [5]. More detailed examples are shown in figure 5. The frequencies at which the resonances occur can be calculated from the electron density and the strength of the earth's magnetic field at the satellite. Alternatively, from the resonance frequencies, it is possible to obtain accurate values of the electron density and magnetic field at the satellite. There are three primary resonances, which we shall designate by f_N, f_H, and f_T. The resonance at f_N depends only on the electron density and is often called the plasma frequency. The resonance at f_H depends only on the ambient magnetic field (resonances on harmonics of this frequency are also observed); this frequency is called the gyromagnetic frequency; its value depends on the strength B of the earth's magnetic field. Finally, the resonance frequency f_T depends both on the electron density and the gyromagnetic frequency. From magnetoionic theory we have that

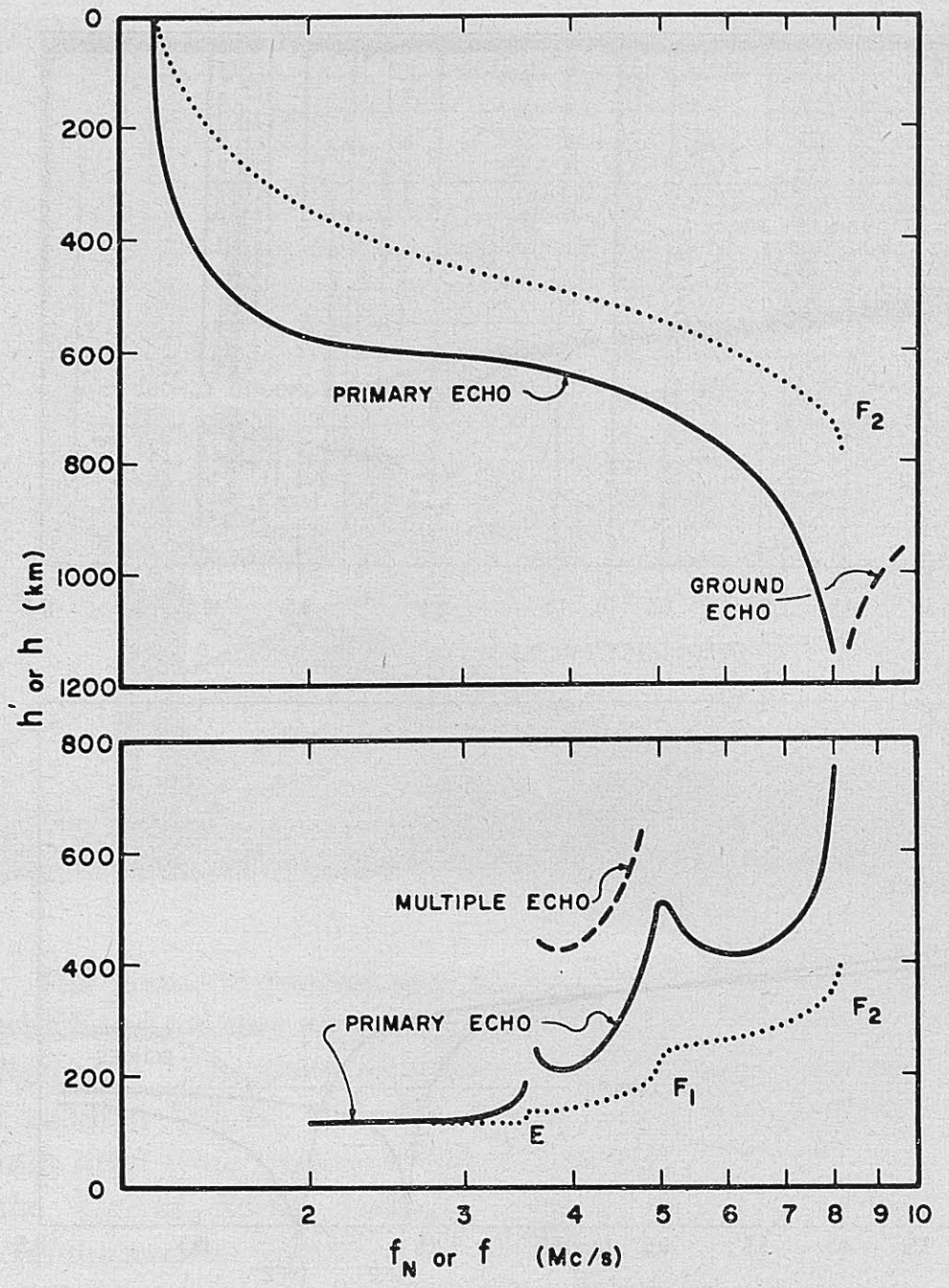
$$f_N\ (c/s) = 9\sqrt{N} \qquad (1)$$

where f_N is in cycles per second and N is the electron number density per cubic meter, and

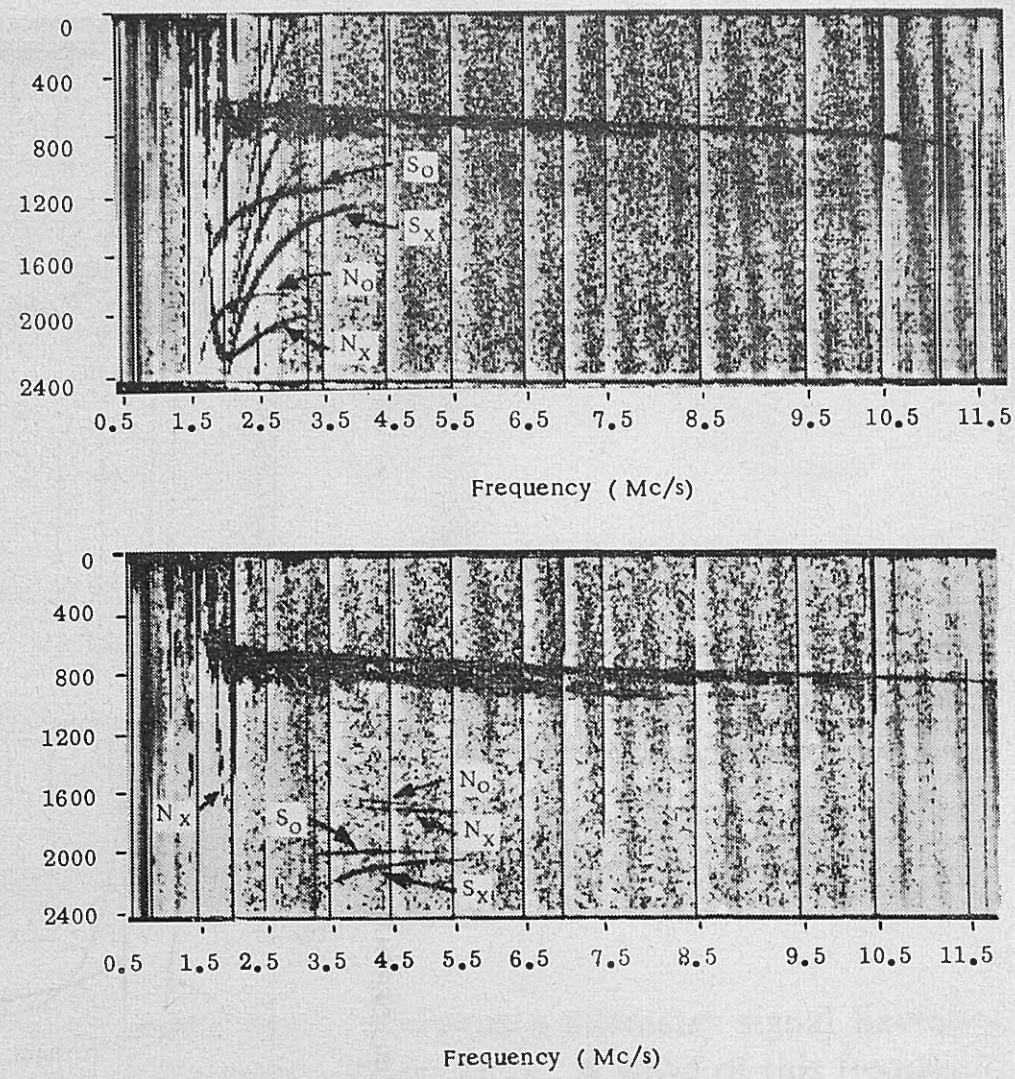
$$f_H\ (c/s) = \frac{e}{2\pi m} B = 2.84 \times 10^{10}\ B \qquad (2)$$

where f_H is in cycles per second, e/m is the charge/mass ratio for an electron in *mks* units, and B is the strength of





▲ *Figure 6 — Sketch of topside and bottomside ionograms with the corresponding electron-density profiles.*



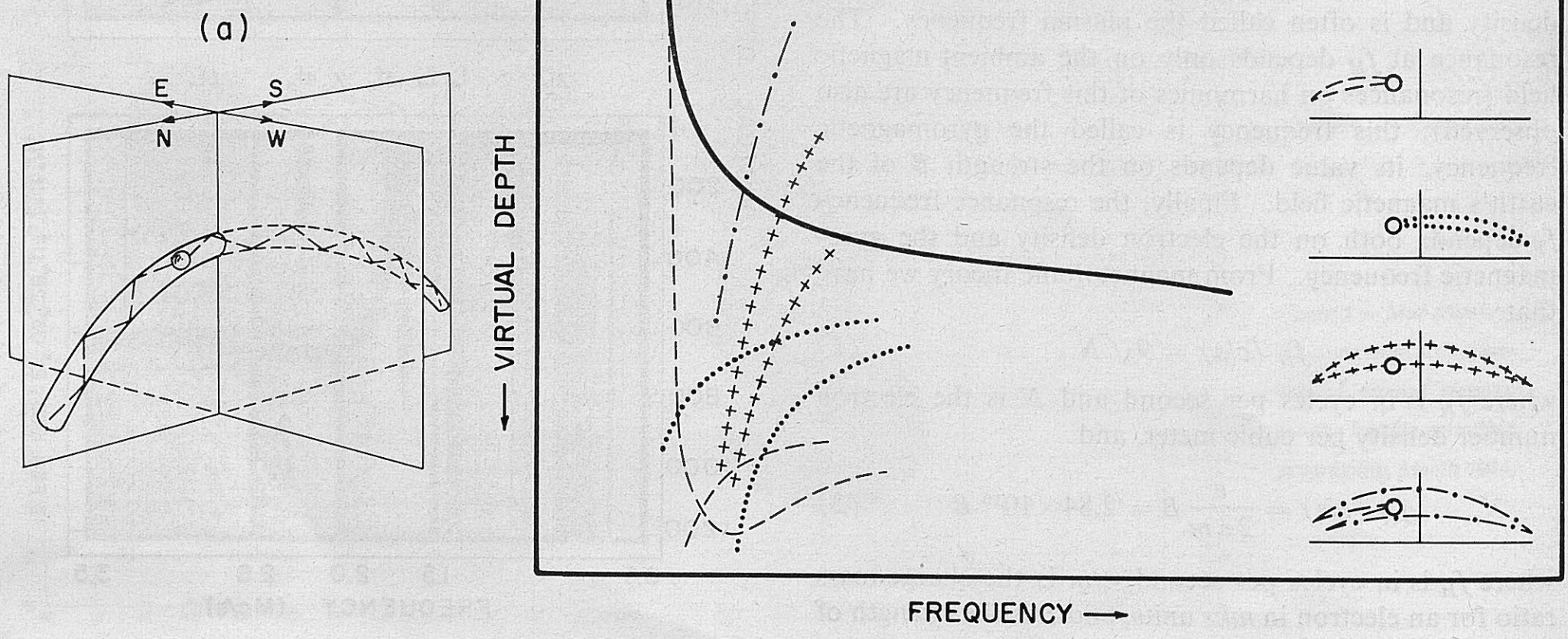
▲ *Figure 7 — Topside ionogram showing spread echoes and echoes ducted along magnetic-field-aligned irregularities.*

the earth's magnetic field in *webers per square metre*, and

$$f_T^2 = f_N^2 + f_H^2 \qquad (3)$$

From ionograms such as that shown in figure 4 and from similar bottomside ionograms, it is possible to derive the electron density distribution over a wide range of heights, as shown in figure 6. The full line is the ionogram trace for the ordinary wave, and the dotted line gives the electron-density distributions above and below the peak of electron density. To obtain the entire profile, these two segments must be connected at the height of the maximum of electron density. It is unfortunate that this height cannot be fixed very accurately with the ionosonde technique. The broken line in the topside ionogram (figure 6) is due to a signal which has penetrated through the ionosphere and is reflected, at the surface of the earth, back to the sounder. The occurrence of these echoes, which is not uncommon, is surprising in view of the low-transmitter power used, the lack of directivity of the antennas, and the double traverse of the absorbing *D* region.

▼ *Figure 8* (below) — *Illustrating the propagation paths of the ducted echoes shown in figure 7.*



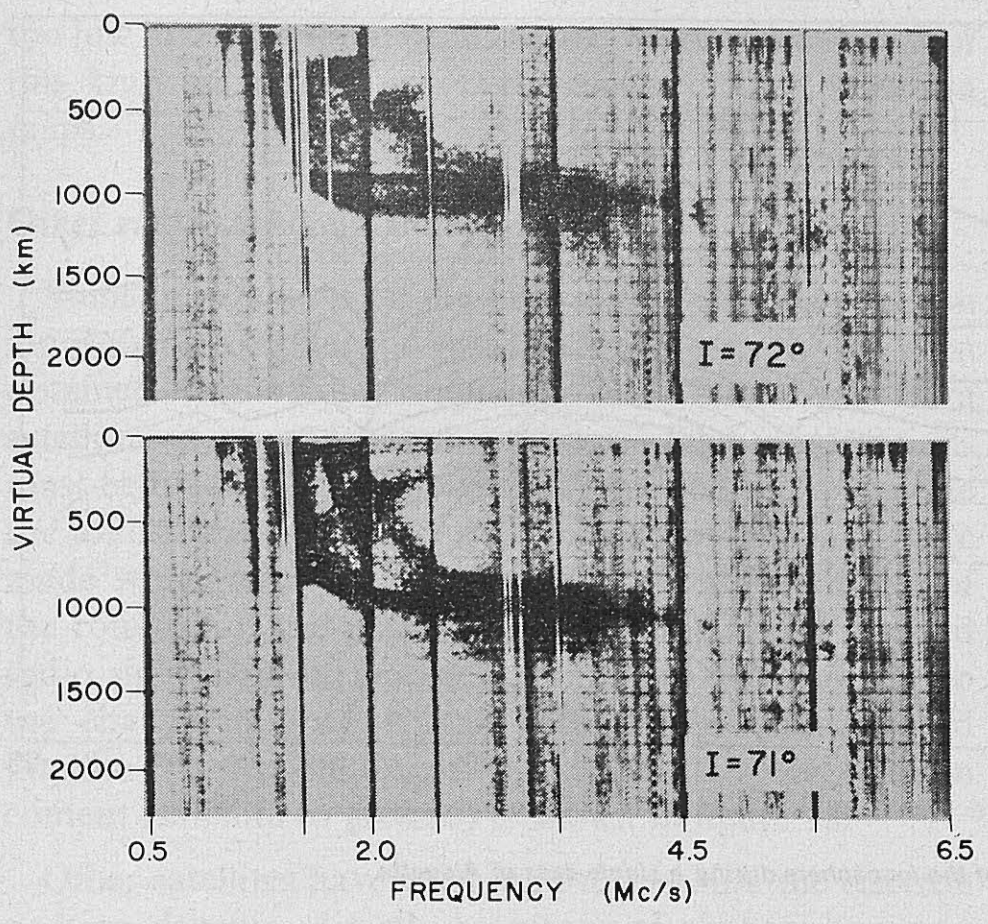


Figure 9 — Spread-F on the topside of the ionosphere.

Another phenomenon which has been observed with Alouette (figure 7) is that of ducting [6]. It appears that the electron density distribution in the ionosphere, and particularly on the topside, is not smoothly varying, but tends to form columns or sheets of slightly greater (or smaller) densities which tend to be aligned along the earth's magnetic field [7]. These columns act like waveguides and conduct the energy down the line of force to a reflection level and back to the sounder, as illustrated in figure 8. This is particularly noticeable near the geomagnetic equator, where successive reflections are possible to the north and south of the equator as seen in figure 8.

The phenomenon of spread-*F*, which is observed on the bottomside of the ionosphere and which is often associated with relatively rapid fading of reflected signals [8], has its counterpart on the topside, as seen in figure 9. As in the case of the bottomside, topside spread-*F* is more prevalent in low and high latitudes as compared with middle latitudes. It is also more common by night than by day. These features are shown in figure 10, which contains contours of percentage of topside ionograms on which the scatter was detected during northern winter (1962-63). It is interesting to note the existence of a mid-morning maximum of occurrence, in low latitudes, which is not revealed by bottomside observations.

Ionospheric mapping

The topside sounder technique may be capable of vast improvements in mapping ionospheric characteristics such as *foF2*. A method of numerical (computer) mapping of such data has been developed at the Central Radio Propagation Laboratory (CRPL) by Jones and Gallet [9]. This method takes the available data and uses them to determine coefficients in certain Fourier series. With these coefficients it is then possible to obtain a value for the desired characteristic (e.g., *foF2*) at any point on the earth and at any time of day. The process is, essentially, one of interpolation, so that the accuracy of a predicted value for a given location will depend on the distribution of observing stations in the vicinity. Thus, over large areas of ocean or desert, the predicted values will be relatively poor as compared with values for the continent of Europe for example. The advantage of a topside sounder, such as Alouette, is that the distribution of data is (at least potentially) much more uniform. Using satellite data it should be possible to correct the existing maps.

While the suitability of topside sounders to provide data on *foF2* is clear, it is not so certain that the shape of the layer near the peak (on which the maximum usable frequency factor of the *F2* layer depends) can be extrapolated to the bottomside with comparable accuracy.

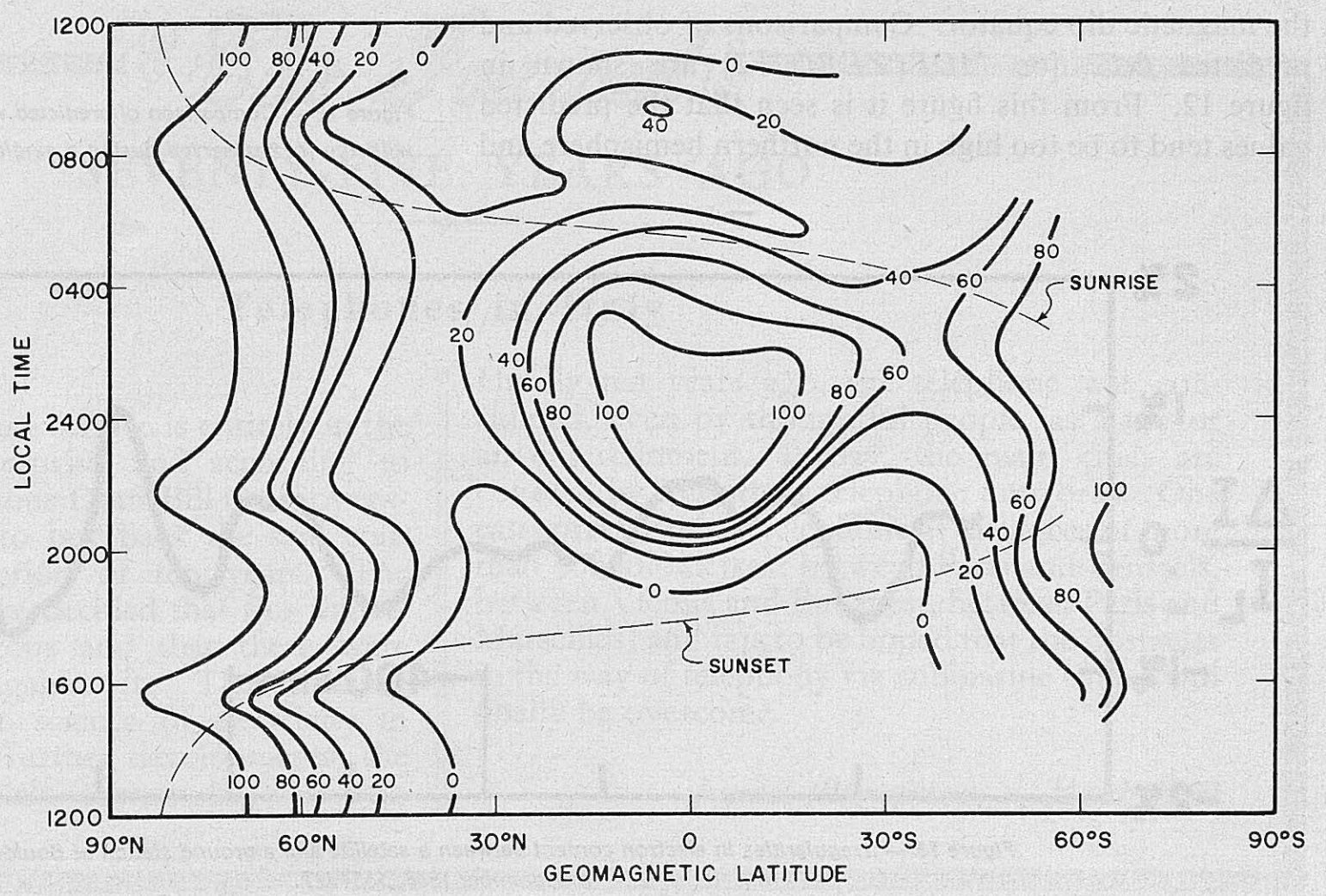


Figure 10 — Percent occurrence of spread-F on topside ionograms.

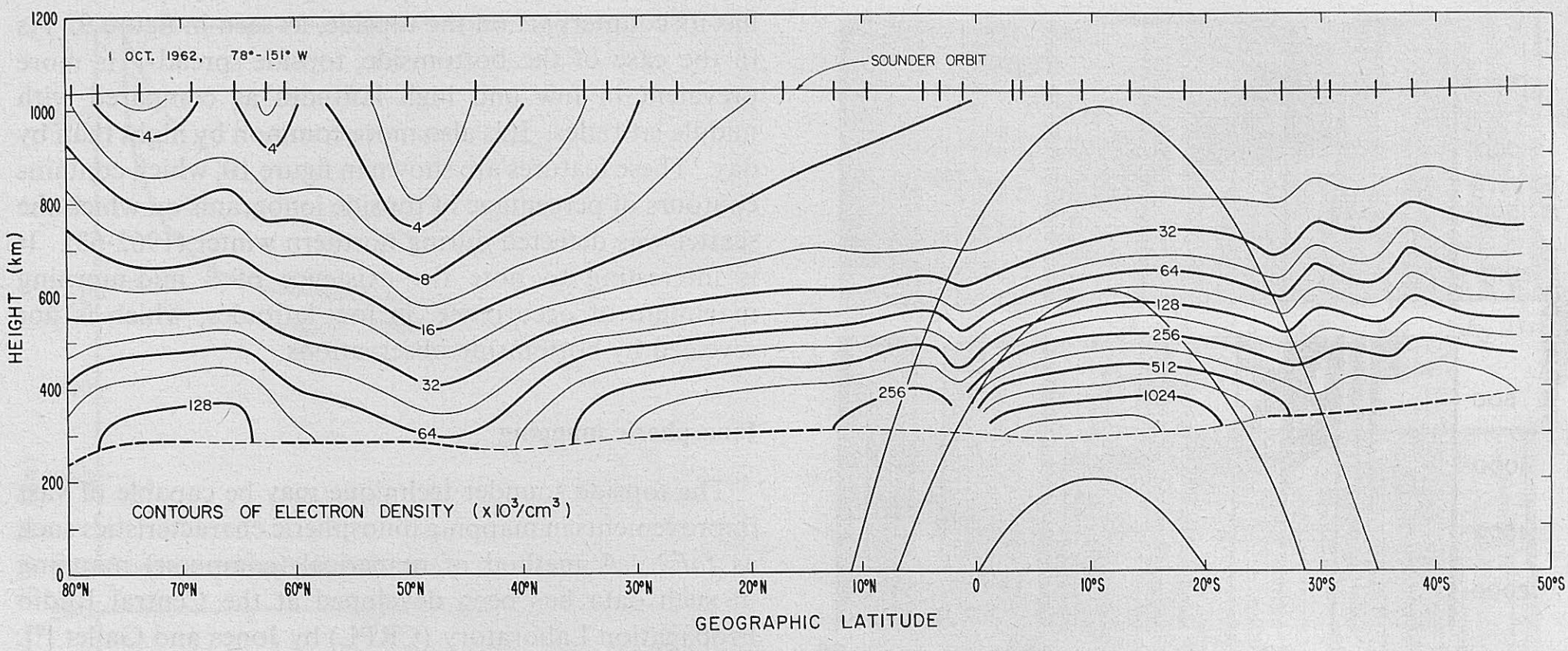


Figure 11 — Electron-density contours of the topside of the ionosphere during a single pass of Alouette.

Answers to this question, which can be obtained from comparisons of topside ionogram data with corresponding bottomside data, must be found before the usefulness of topside sounders in ionospheric mapping is fully realized.

Because of the close connection between the sunspot number and the electron density distribution in the ionosphere, it is necessary to conduct long-term (or synoptic) observations aimed at a description of the major variations of the ionosphere. These observations should cover at least one half of a solar cycle, that is, about five or six years.

An example of the sort of information which may be of use in radio propagation is shown in figure 11. This consists of a set of contours of electron density which are of use in tracing radio rays through the ionosphere [10]. Similar contours for the bottomside have been presented by Wright [11]. The shape of the lines of force of the earth's magnetic field in low latitudes is shown to emphasize the geomagnetic distortion of the ionosphere near the magnetic dip equator. Comparisons of observed and predicted *fxF2* [or *MUF(ZERO)F2*] are shown in figure 12. From this figure it is seen that the predicted values tend to be too high in the northern hemisphere and

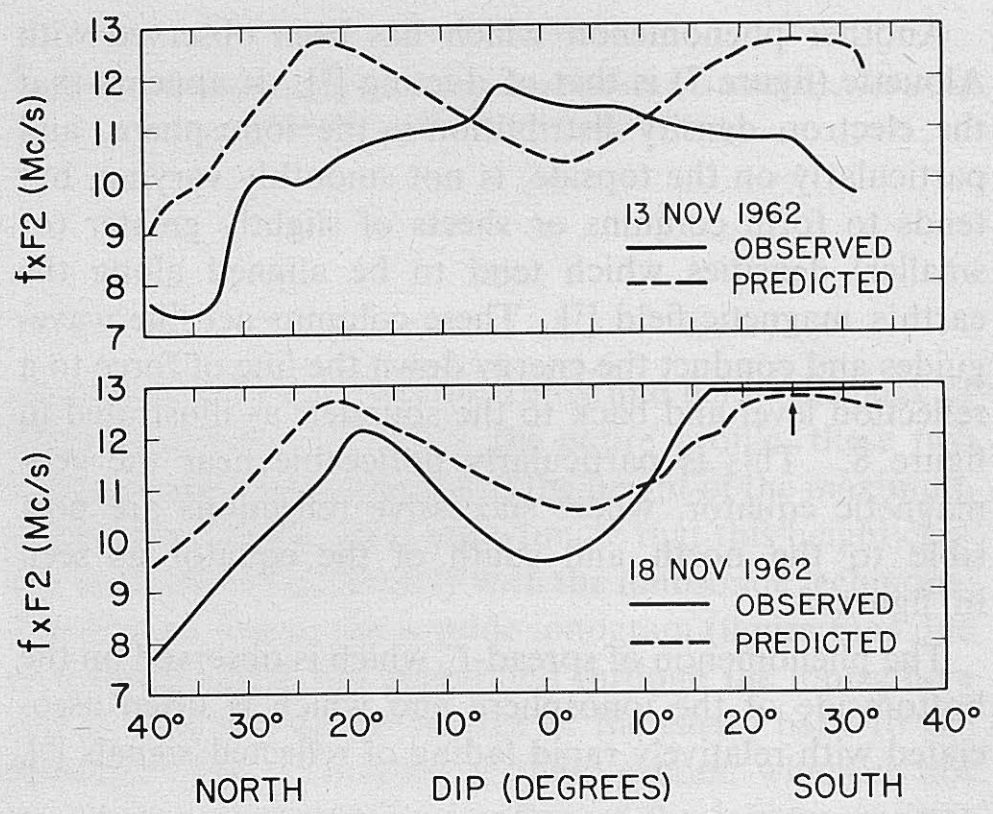


Figure 12 — Comparison of predicted values of monthly median values of foF2 with the foF2 observed during a single pass of the topside sounder Alouette.

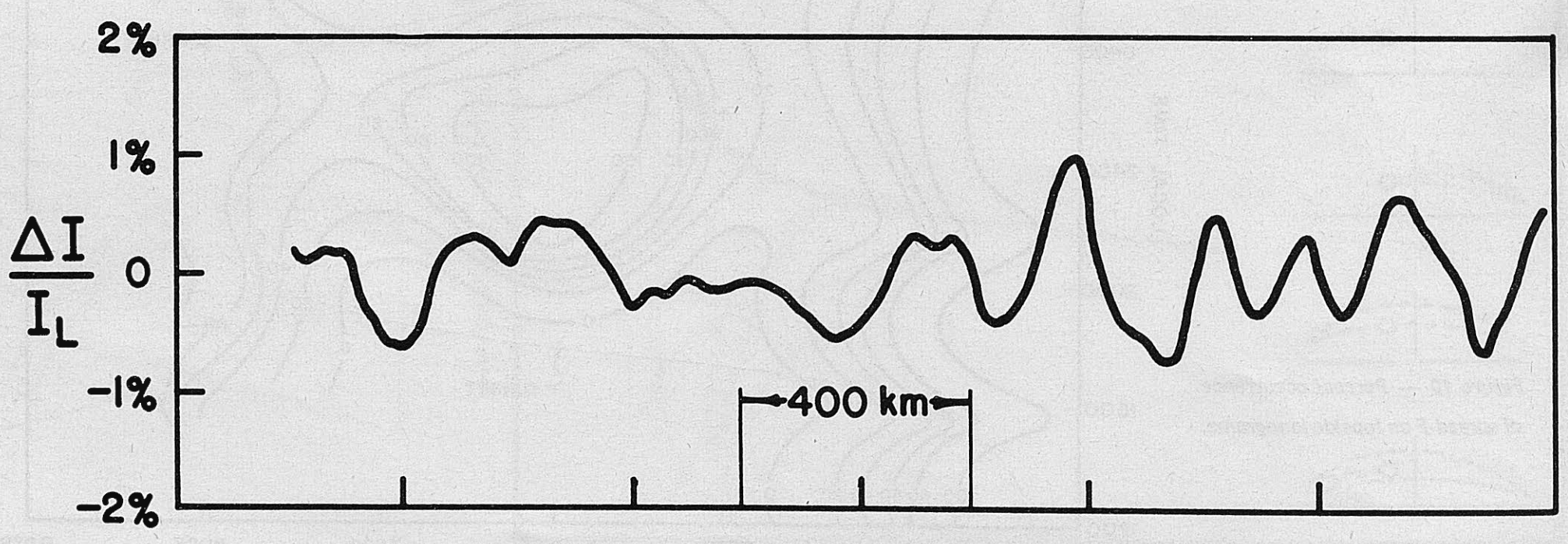


Figure 13 — Irregularities in electron content between a satellite and a ground station at Boulder, Colorado. 4 September 1958, 1534 UT.

too low in the southern hemisphere. More comparisons of this kind are needed in order to correct the prediction maps.

Other radio soundings from satellites

Some information on the total electron content and on ionospheric irregularities (or clouds of electrons) has been obtained from fixed frequency radio emissions from satellites to ground based receivers. Such observations must be made at frequencies sufficiently high to penetrate the ionosphere. The first observations of this kind were made with *Sputnik 1* and consisted of measurements of the rotation of the plane of polarization of the received radio signal and of Doppler change in frequency due to the change in optical path between the sounder and satellite [12]. An example of the variation in total electron content (satellite to ground) is shown in figure 13.

Other satellites have been used to measure the electron and ion densities directly by means of probes; however, consideration to the type of measurement is beyond the scope of this paper.

Concluding remarks

Satellites in general and topside radio sounders in particular have already played an important role in revealing the structure of the upper parts of the ionosphere. The extent to which such data can be applied to radio communications *via* the lower side has not yet been fully assessed. All indications are that such sounders as Alouette will be of great value in the world-wide mapping of the *F2* layer. Additional information may also be obtained on the annoying phenomenon known as spread-*F*, which sets limitations on the quantity and quality of radio communications. With the advent of more satellite sounders, our knowledge of the ionosphere should increase greatly.

(Original language: English)

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The Journal

SEVENTY-FIVE YEARS AGO

Telephones in Italy

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In Italy, the telephone service is entirely in the hands of private enterprise, and according to Article 18 of the previous Draft Bill the Government undertook not to buy back the said concessions within a period of ten years. The Government must have decided that this undertaking was too onerous and that there were serious arguments against it. The amazing progress made in the science of electricity in recent years presages further developments, the repercussions of which cannot be foreseen.

Hardly ten years ago, the telephone was considered, even by thoughtful people, as a toy or an entertainment. To-day, the main cities are covered by important telephone networks. One can correspond by telephone at distances of more than 800 kilometres: between Paris and Brussels, between Vienna and Budapest, between Paris and Marseilles; and it is to be hoped that the obstacles in the way of telephony via submarine cables will finally be overcome.

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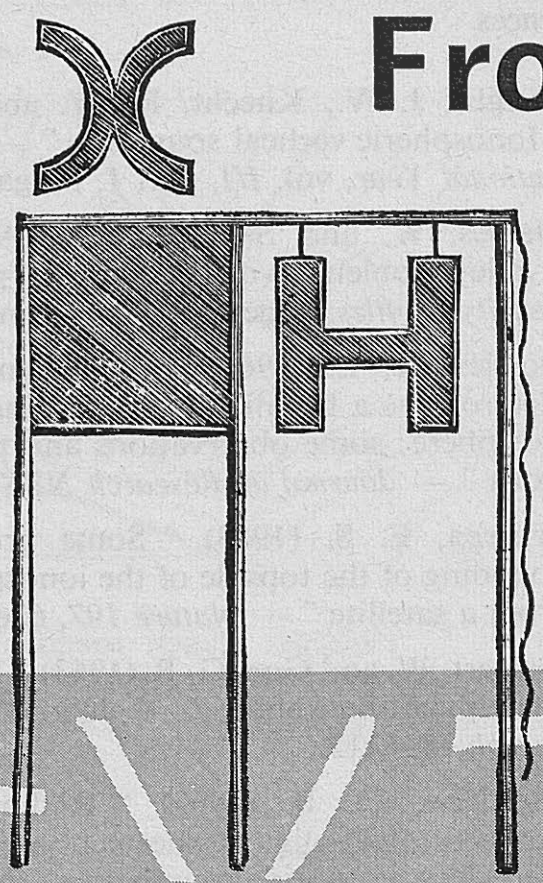
Journal télégraphique — March 1890

During the ITU's Centenary Year, the Journal *is presenting a condensed serialization of this book which will be published this month*



From Semaphore to Satellite

III

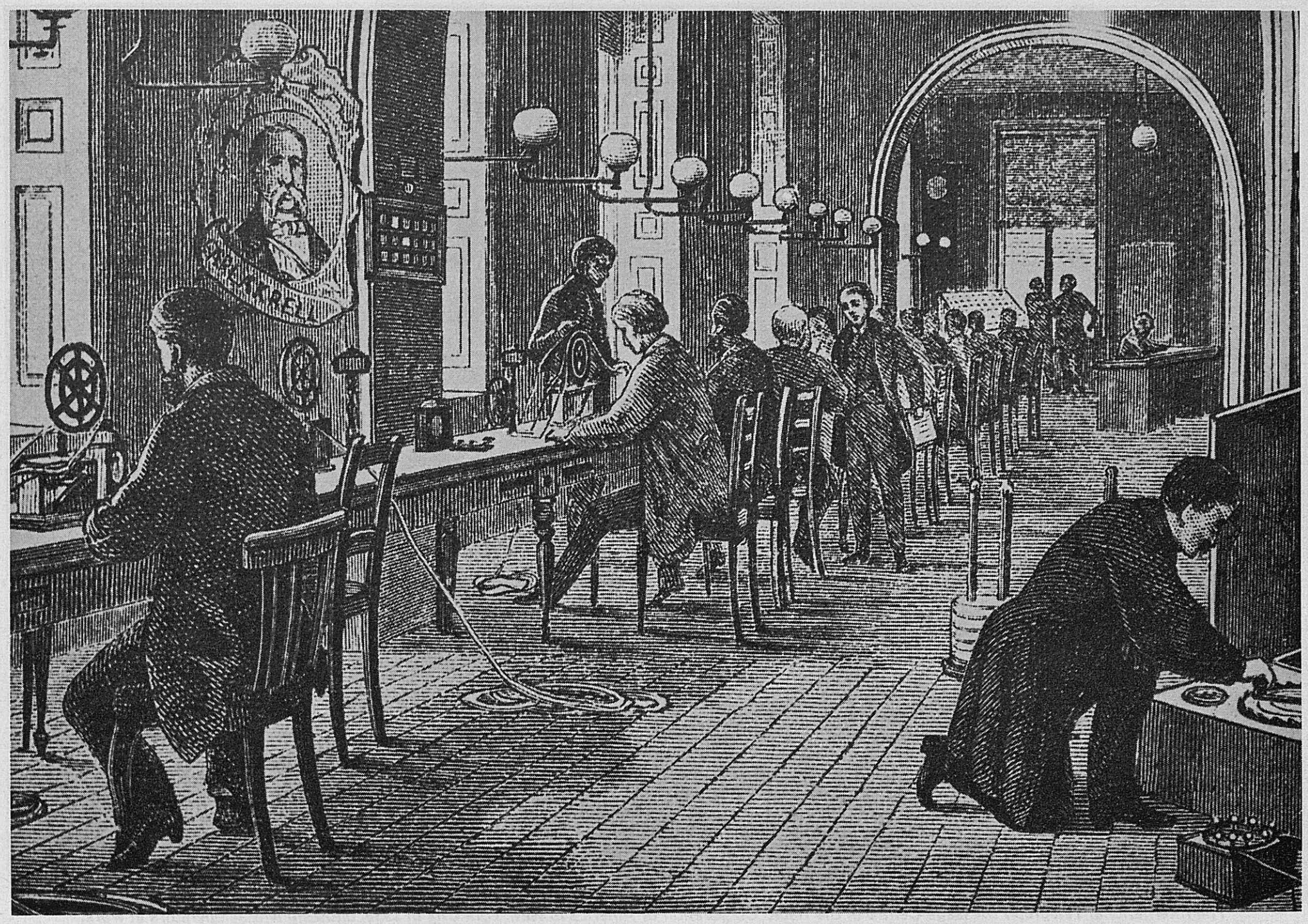
Telegraph Rates, Priorities and Codes

ONE OF THE PRIMARY OBJECTS in calling together the first International Telegraph Conference in Paris in 1865 was to fix an acceptable tariff for telegrams. More time has been devoted to rates and tariffs than to any other subject at this and at all subsequent telegraph conferences of the International Telegraph Union. The two basic demands were for cheap international rates, so that the public would use telegrams as much as possible, and for a fair compensation for the various Government Administrations and private telegraph companies.

Competition from new scientific discoveries, the telephone and radio, economic changes, such as the devaluation of currencies, and the cost of nationalizing private telegraph companies, were some of the factors which made agreement on international telegraph tariffs an ever new and always controversial subject for discussion at international conferences.

Dramatic changes have occurred in telegram rates during the last century. For instance, in Great Britain in the early 1850's a telegram of twelve words between London and Manchester cost 5 shillings. In 1870, when the British Post Office had acquired the exclusive right to transmit telegrams within the United Kingdom, the

London 1840: Mail coaches often took the name " Telegraph " to advertise their speed. Here the " Cambridge Telegraph " is ready to start its run.



The Central Telegraph Exchange in Stockholm in 1872. On the wall is the portrait of the Director-General, Carl Akrell.

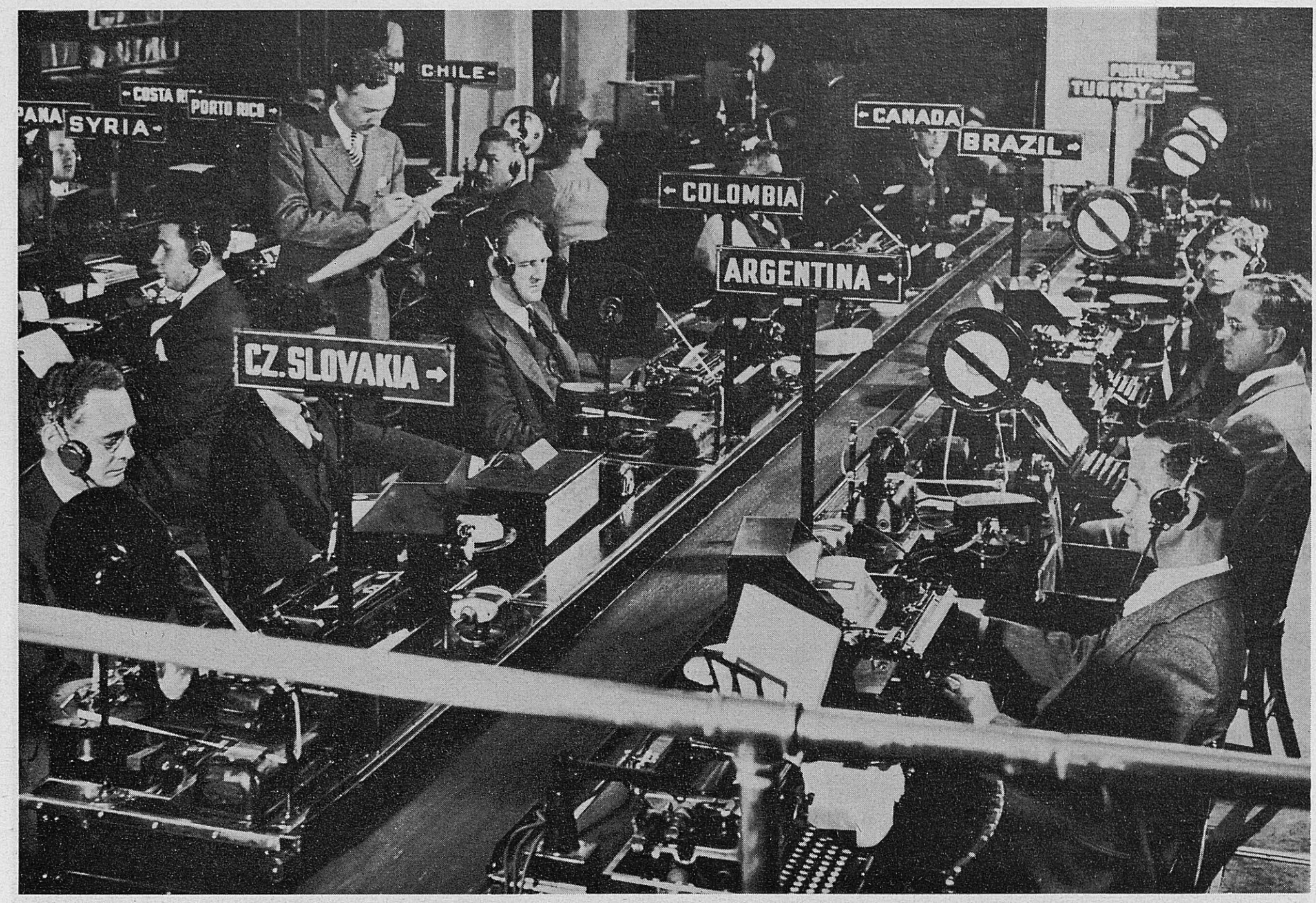
charges for the same telegram had been lowered to 1 shilling. The lowest cost ever, in 1885, when 90 million telegrams were sent annually, was 0.5 shilling for a twelve-word telegram. At present the cost of a twelve-word telegram from London to Manchester has again risen to 5 shillings, almost twice as much as a 3-minute telephone conversation between the two cities.

If an international telegram is sent, say from Rome to London, then further financial complications immediately arise. The country of origin, Italy, and the country of destination, Great Britain, levy a charge for handling the telegram on dispatch and on delivery, the so-called terminal charges. In addition, if the telegram is routed through Switzerland and France, these two countries charge their own transit rates.

At the time of the first Conference in Paris in 1865, several countries had different terminal charges, depending on the country of origin of the telegram they received. For example, Württemberg had a terminal charge of 3 francs for telegrams from all other Members of the Union, except for France, Italy and Switzerland, which were only charged 1 franc. Russia and Turkey also presented an exception, as they demanded different terminal charges according to the distance of the final delivery from their national frontiers. All these different terminal and transit charges were for the first time codified and published in a table annexed to the Convention of the Paris Conference.

Twenty years later, at the Administrative Conference of Berlin, a new system was established, which is still to-day the basis of the Telegraph Regulations of the ITU. In 1885, the world was divided into two parts: Europe and extra-Europe. For Europe "*une seule et même*" elementary terminal charge and "*une seule et même*" transit charge were adopted for all states. The terminal charge was then 10 centimes per word, and later lowered to 6½ centimes; to-day it is laid down in the Telegraph Regulations that it should not exceed 15 centimes. For transit charges per word, the figures were 8 and 4 centimes and are to-day a maximum of 5 centimes. The Union of Soviet Socialist Republics have still to-day a maximum terminal charge of 32 centimes and Turkey one of 18 centimes.

Agreement on the terminal charges for telegrams outside Europe was not reached until the Administrative Conference of Paris in 1925, when maximum payments were established. The minimum number of words for a telegram inside Europe was also the subject of much discussion at the various conferences of the Union. A minimum of twenty words was for a long time the established figure; to-day it has been lowered to seven words, in the case of press telegrams to 14 words, and for letter telegrams to 22.



The International Telegraph Message Centre of the Radio Corporation of America in New York City in 1933, showing Morse operators at work.

The basic monetary unit

For all international accounting purposes, the French franc was accepted as the unit from the Paris Convention of 1865 onwards. This was revised in 1925, when the gold franc had to be defined as the value of 100 centimes of a weight of 10/31 gram of gold of purity 0.900. This is still to-day the international unit for all telegraph accounts. When in 1931 Great Britain and many other countries left the gold standard but retained their old telegraph rates, this led to renewed difficulties. Many continental telegraph users then found it cheaper to send their extra-European telegrams via England; in spite of the desire of the continental and the British telegraph authorities to detect and to arrest this practice, it was impossible to stamp it out entirely.

The priority of telegrams is another old telegraph practice dating back to the days of the optical telegraph. It is still in force to-day. In the early days Government telegrams always came first, followed by service telegrams originating either from the railways or later the telegraph Administrations, and lastly came the only telegrams that were paying, the social telegrams of the public and the commercial telegrams of industry and finance.

A strict order of priorities is laid down in the current Telegraph Regulations issued by the ITU. Article 61 states that " telegrams relating to the safety of life on land, sea, or in the air, and exceptionally urgent epidemiological telegrams of the World Health Organization shall have absolute priority over all other telegrams "; they bear the prefix: = SVH =. Next come telegrams of the United Nations arranged in the following order: the President of the Security Council, the President of the General Assembly, the Secretary-General, the Chairman of the Military Staff Committee and so forth; certain United Nations telegrams have the prefix: = ÉTAT PRIORITÉ NATIONS =. Service telegrams, relating to serious interruptions of channels of telecommunications follow, having as prefix: = ADG =. Fourthly in order of transmission come Government telegrams for which priority has been requested; they must bear the paid service indication: = ÉTAT PRIORITÉ =.

Meteorological telegrams come next, identified by their prefix: = OBS =. Then follow urgent service telegrams, urgent service advice, paid service advice, urgent private telegrams, urgent RCT telegrams (dealing with persons protected in time of war by the Geneva Convention) and urgent press telegrams, all bearing the prefix: = URGENT = followed by the second prefix identifying the category. So for example an urgent press telegram would have the identification: = URGENT PRESS = as a prefix.

Then finally follow ordinary telegrams either of a private, government, or press nature, and letter-telegrams which in the case of European ones carry the prefix: = ELTF = if they come from a Government, or simply

Electronic message switching system of the International Telegraph Message Centre of the RCA Central Telegraph Office, New York, 1963.

= ELT =. Outside Europe, Government letter-telegrams have = LTF =, and private ones = LT =. There are of course many other prefixes defined in the Telegraph Regulations, as for example = LXDEUIL = meaning a de luxe telegram on the occasion of a mourning and = TR = meaning telegraph restant.

The problems of codes

Sending coded telegraph messages is a practice even older than the electrical telegraph, and the reasons for using codes have been the same for both the optical and the electrical telegraph: secrecy and economy.

It is doubtful to-day if secrecy can still be considered the major reason for the use of commercial codes. Whereas in the past it took weeks and months to break a code, this operation can now be performed by electronic computers in a matter of a few hours if they have been suitably designed and programmed for this task.

Using codes for reasons of economy has also sometimes been self-defeating. Telegrams drafted in code were far more difficult to handle, as they had to be read and transmitted letter by letter. The difference of a single letter could change the whole meaning of a code telegram and operators were therefore often asked to repeat parts of, or even whole, telegrams. Naturally, the telegraph Administrations wanted to be compensated for the extra time and work involved.

The early telegraph conventions and regulations permitted the public to draft its telegrams in any one of the " plain " languages used by Members of the Union, the only restriction being the length of words; they should not exceed seven syllables. By 1909, 47 official languages had been accepted by the Union, and amongst them we find Ammonitish, Annamese, Chinese, Croatian, Hebrew, Icelandic, Illyrian, Kiswahili, Lao, Latin, Luganda, Luxemburgian, Persian, Ruthenian, Siamese, Slovak and Slovenian, Turkish and Wolof.

The current Telegraph Regulations drawn up by the ITU give no specific list of languages, but allow Latin and Esperanto. In addition they allow as plain language telegrams those to and from China, which are drafted in a four figure code, provided they are taken from the official telegraph dictionary of the Chinese Administration.

This might be the end of plain language telegrams, but as the early regulations allowed plain words up to seven syllables, and as code words in telegrams were only allowed five letters, misuses of this distinction soon developed. So for example an early telegraph manual cites the following code words:

APOGUMNOUMAI
APUGUMNOSOMETHA
EKMISTHOSOISTHEN
CHINESISKSLUTNINGSDON (21 letters, but only six syllables).

▲ *Overhead line construction, mounting of traverse supports on pole.*

(Opposite page) Open-wire telegraph line carrying 12 channels in northern Finland. In remote areas where underground cable laying is not practical, use is still often made of open-wire lines. Severe weather conditions impose very great requirements on the maintenance of the systems.

They were certainly all pronounceable, but what their meaning was has apparently not been preserved.

At the early conferences, St. Petersburg 1875, London 1879, and Berlin 1885, attempts were made to control the length of code words to a maximum of 15 and 10 letters and to charge them at the same rate as plain language telegrams. But code users were not satisfied and new misuses occurred.

Dictionary words were intentionally misspelt and completely manufactured words, resembling dictionary words, were soon in use. At the Conference of Paris in 1890, a proposal was therefore made and accepted that the Union Bureau at Berne should draw up a complete official dictionary of all the permissible code words. Such an official vocabulary was indeed compiled, containing in alphabetical order 265 740 words, and 15 000 copies of it were distributed. Many criticisms were levelled against it, from insufficiency of numbers of words to typographical mistakes. The Budapest Conference of 1896 therefore instructed the Bureau to extend and to improve the official vocabulary.

The Bureau set to work in an extremely thorough manner, and from the Members of the Union requested copies of all authorized codes; they received 218 public and private codes containing a total 5 750 000 words. Work commenced in February 1897, and by May 1901 four large volumes and one appendix, containing over 1 900 000 words were published and 7000 sets distributed; the cost was 300 000 Swiss francs. But this new official vocabulary was no more successful than its predecessor, and the London Conference of 1903 found it unacceptable, mainly because it did not contain sufficient words and because it rendered many private codes useless. The only alternative lay in standardizing and legalizing the then existing codes.

It was also laid down in the 1903 Telegraph Regulations that code language words must be pronounceable and not be longer than ten characters according to the Morse alphabet. But the Union had not reckoned with the ingenuity of code compilers. In 1904, when these new regulations came into force, a completely new code system had been devised, consisting entirely of five-letter code words. By combining two such code words, the new word could be passed off as one ten-letter code-word and thus cutting the cost of the telegram in half. The user, in order to convince the telegraph operator of their pronounceability, would manage " by means of facial contortions to pronounce words containing up to four or five consecutive consonants. "

To legalize the existing codes, the Union set up a Code Control Committee which was active between 1908 and 1913. Strict censorship during World War I prevented of course the use of any coded telegrams for the public, but after the war the code problem immediately resumed its intractable nature. Many new codes were compiled, and the Union set up another Committee for the Study of Code Languages; it met in Paris in 1925 and again in Cortina d'Ampezzo in 1926. Its majority report, fourteen countries, allowed only five-letter codes to be used; the minority report, by Great Britain alone, wanted to retain the ten-letter codes. At the subsequent Administrative Conference of Brussels in 1926, two code categories were allowed, *Category A* of pronounceable ten-letter words, and *Category B* of five-letter words made up in any way the user liked.

The current Telegraph Regulations allow only artificial words up to five letters; telegrams can also now be sent in which real words are used but having a meaning different from their normal content in plain language.

(Original language: English)

review review review

A list of articles in other technical publications which may be of interest to readers of the Journal. The articles are listed under the language of the publication.

FRENCH

Câbles et transmission. 16, rue de la Baume, Paris 8e. Année 1965. No **1.** P. 9-20. *Colin J.-E.* Les filtres dissociés passe-bas et passe-haut. — P. 27-29. *Desdames B.* Réalisation d'un filtre coupe-bande spécial au moyen de structures à deux bras et à trois pulsations de coupure. — P. 45-54. *Eldin J.* La fiabilité.

Commutation et électronique. SOCOTEL, 38-40, rue du Général-Leclerc, Issy-les-Moulineaux (Seine). Année 1965. No **8.** Numéro entièrement consacré au système téléphonique parisien.

Electronique industrielle. 49, rue Jacob, Paris 6e. Année 1965. No **80.** P. 11-15. *Damaye R.* Les éléments photosensibles à semi-conducteurs. — P. 25-28. *Calvez J.* Indicateur-régulateur à commande photo-électrique. — P. 29-34. *N.C.* Analyseur électronique automatique de couleurs.

Nucleus. 22, avenue Foch, Paris 16e. Année 1964. No **6.** P. 424-433. *Delobeau F.* Chronique de l'espace.

Radio constructeur et dépanneur TV. Société des éditions radio, 42, rue Jacob, Paris 6e. Année 1965. No **206.** P. 42-45, 71. Amplificateurs video à tubes et à transistors.

Radio-REF. 60, bd de Bercy, Paris 12e. Année 1965. No **2.** P. 83-88. *Bertemes A.* Bientôt « Oscar III ». — P. 89-94. *Bastide J.* Sélectivité basse fréquence.

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British Communications and Electronics. Heywood and Co. Ltd., Drury House, Russell Street, Drury Lane, London WC 2. Year 1965. No **2.** P. 98-103. *Hooper J.* Frequency conservation for point-to-point radio systems.

CQ, the Radio Amateur's Journal. 14 Vanderventer Avenue, Port Washington, L.L., N.Y. 11050. Year 1965. **No. 1.** P. 24-27, 98. *Tucker D. J.* RTTY from A to Z. — P. 32-36, 105. *Orr W. I.* Triodes for linear amplifiers. — P. 49-55, 87. Antennas.

EBU Review. European Broadcasting Union Technical Centre, 32, Avenue Albert-Lancaster, Brussels 18. Year 1964. **No. 88-A.** P. 250-259. *Guillermin J.* Statistical investigations of the audio signal with special reference to its dynamic control.

Proceedings of the Institution of Electrical Engineers. Savoy Place, London WC 2. Year 1965. **No. 2.** P. 231-241. *Chamberlain J. K.* Interference between an earth station of a communication-satellite system and the stations of terrestrial line-of-sight radio-relay systems. — P. 259-268. *Rama Rao B.* Current distribution and impedance of an antenna in a parallel-plate region. — P. 296-300. *Mehta V. B.* Comparison of RC networks for frequency stability in oscillators. — P. 301-309. *Sutcliffe H.* Noise-spectrum measurement at subaudio frequencies. — P. 396-407. *Humpage W. D., Sabberwal S. P.* Phase-comparison methods in automatic synchronising. — P. 408-415. *Barrie I. T.* Measurement of very low dielectric losses at radio frequencies.

QST. American Radio Relay League, 225 Main Street, Newington, Connecticut 06111. Year 1965. **No. 1.** P. 25-28. *Grammer G.* The whys of transmission lines. — P. 32-36. *Skeen W. S.* Low-cost precision frequency measurement. — P. 37-39. *Michael V. A.* Tracking the Moon. — P. 46-50. *Countryman G. L.* Silicon replacement of tube rectifiers—some necessary precautions.

RSGB Bulletin. 28 Little Russel Street, London WC 1. Year 1965. **No. 1.** P. 14-16, 24. *Martin P. G.* Progressing through amateur radio. — P. 32-36. *Blanchard W.* Panoramic reception *(Part 1:* Design considerations).

No. 2. P. 85-91. *Blanchard W.* Panoramic reception (*Part 2:* Practical design and constructional details.) — P. 97-102. *Weber F.* Tunnel diode amplifiers with a practical design for a parallel amplifier on 70 cm.

73 Magazine. Peterborough, New Hampshire. Year 1965. **No. 1.** P. 16-21. *Hughes M.* Diode controlled break-in. — P. 40-45. *Kyle J.* Automatic load control for SSB. — P. 70-74. *Hoisington B.* Low cost, powerful Two'er linear.

Wire and Radio Communications. Communications Publishing Corporation, PO Box 50, Verona, New Jersey. Year 1964. **No. 11.** P. 7-14. *White R.* Noise performance in industrial microwave systems. — P. 26-29. *Milne D. D.* A new generation of microwave. — P. 68-72. *Smee P. G.* A modern pipe line communication system. — P. 83-87. *Albertson J. N.* Space diversity on the microwave system of the Southern Pacific.

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SPANISH

INE - Revista de información electrónica. Instituto nacional de electrónica, Ríos Rosas 54, Madrid. Año 1965. N.º **29.** P. 5-12. *Palacios J.* Propagación de la luz en los sistemas inerciales móviles. — P. 13-30. *Thourel L.* Generadores de estado sólido para micro-ondas.

Revista española de electrónica. Apartado 5252, Barcelona. Año 1965. N.º **122.** P. 42-43. Ajuste de receptores de FM (II). — P. 46-49. Impedancia de entrada y readmisión en los circuitos a transistores. — P. 50-51. La sincronización automática horizontal (I).

Communication from the Specialized Secretariat of the CCIR

Solar indices for ionospheric propagation

THE FOLLOWING TABLES, giving values of the basic indices for ionospheric propagation have been prepared by the Specialized Secretariat of the International Radio Consultative Committee (CCIR) in accordance with CCIR Resolution 4, Recommendation 371, and Report 246.

Note: A considerable amount of information on ionospheric indices will be found in an article by C.M. Minnis, entitled *Ionospheric indices* on pages 1-36 of the recent publication *Advances in radio research*, volume 2, edited by J.A. Saxton (Academic Press, London and New York, 1964).

Parameters:

● R_{12} (smoothed mean, over twelve months, of the number of sunspots observed):

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1963	29	30	30	29	29	28	28	27	27	26	23	21
1964	19	17	15	13	11	10						

● I_{F_2} (ionospheric index):

Month (year 1964)

1	2	3	4	5	6	7	8	9	10	11	12
0(2)*	6(2)*	20(2)*	14(2)*	1(2)*	–3(1)*	1(1)*	–3(1)*	4(1)*	3(1)*	-3(1)*	-4(1)*

Month (year 1965)

1	
7(1)*	

** The figures in brackets represent the number of values of foF_2 which have not yet reached the CCIR Secretariat, and which have not therefore been taken into account in the calculation of I_{F_2}. For further details, see the* Telecommunication Journal, *April 1964, page 119.*

With regard to the data contained in CCIR Report 246, one ionospheric sounding station has ceased to operate—Puerto Rico (in June 1963). The values of I_{F_2}, that include the figure (1) in brackets are therefore, as from the month of June 1963, definitive values for I_{F_2}. Furthermore the sounding station Fairbanks did not operate during the period August-October 1963. For this period the definitive values of I_{F_2} are those including the figure (2) in brackets.

● Φ (monthly mean value of solar noise flux) **:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1964	74	76	75	73	69	69	67	69	70	73	73	78
1965	78											

*** Data kindly supplied by the National Research Council, Ottawa.*

Forecasts for the next few months (1 March, 1965)* :**

● R_{12}

Year \ Month	2	3	4	5	6	7
1965	13	14	15	16	18	20

**** Data kindly supplied by Professor Waldmeier, Federal Observatory, Zurich.*

Estimated error in forecasts of R_{12}: ± 10

● I_{F_2} ****

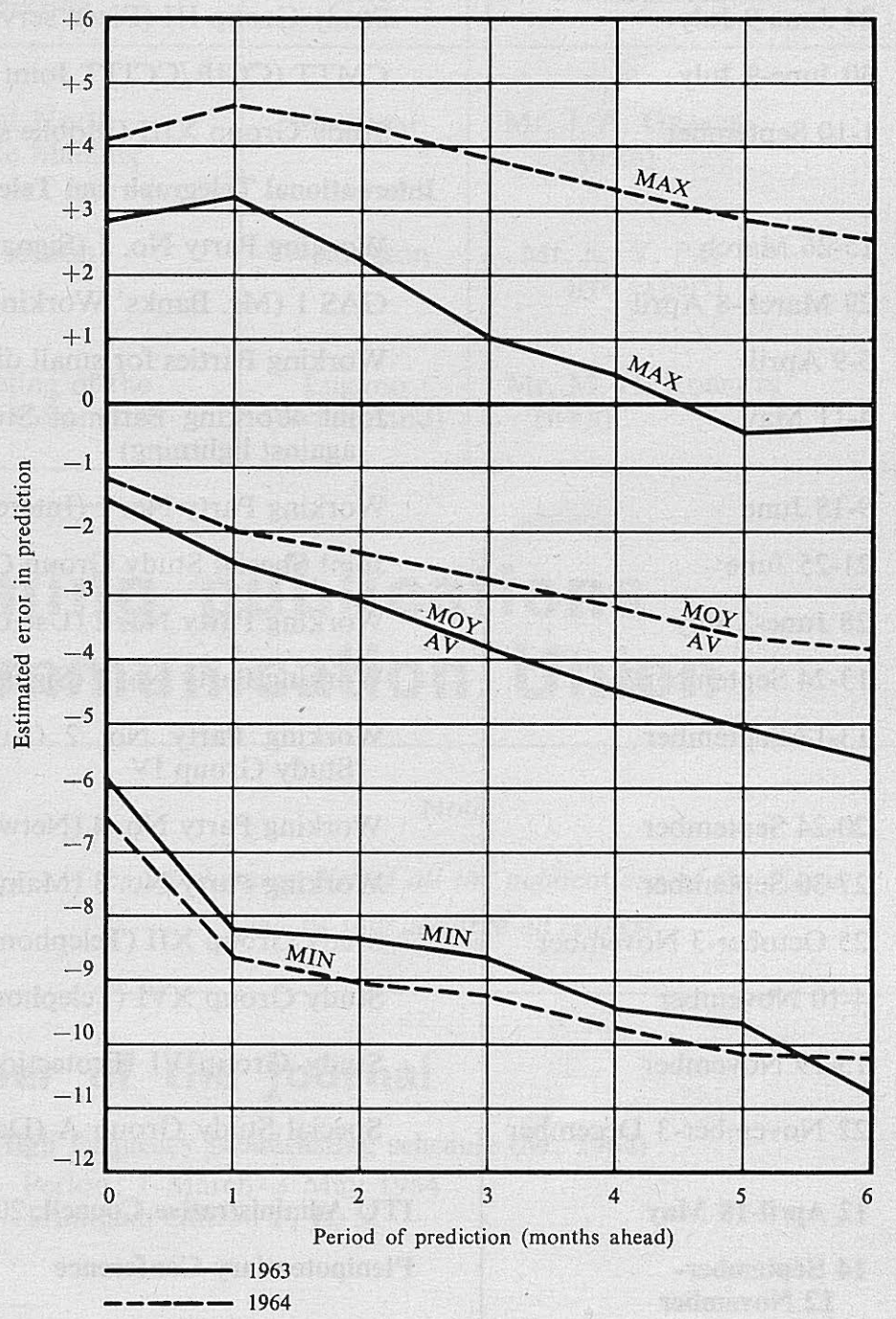
Year \ Month	1	2	3	4	5	6	7
1965	—4	—3	—2	—1	0	1	(3)

**** *Data kindly supplied by the Department of Scientific and Industrial Research, Radio Research Station, Slough.*

The figure in brackets is the value forecast six months in advance.

Estimate of the error in I_{F_2} predictions:

Month (1965)		1	2	3
Maximum		+4	+4.5	+4.5
Minimum		—6.5	—8.5	—9
Month (1965)	4	5	6	7
Maximum	+4	+3	+3	+2.5
Minimum	—9	—10	—10	—10



Analysis of I_{F_2} predictions during 1963 and 1964

official announcements

Calendar of ITU conferences and meetings

Date	Title	Place
1965		
	International Telegraph and Telephone Consultative Committee (CCITT) and **International Radio Consultative Committee (CCIR):**	
29 March-9 April	Plan Committee for Latin America	Santiago (Chile)
	International Radio Consultative Committee (CCIR):	
10 February-2 March	Study Group IV (Space systems and radio astronomy)	Monte Carlo
10-23 February	Study Group VIII (International monitoring)	Monte Carlo
24 February-12 March	Study Group IX (Radio-relay systems)	Monte Carlo
3-12 March	Study Group VII (Standard-frequencies and time signals)	Monte Carlo
24 March-7 April	Study Group X (Broadcasting)	Vienna
24 March-7 April	Study Group XI (Television)	Vienna
9-22 June	Study Group V (Propagation over the surface of the earth and through the non-ionized regions of the atmosphere)	Geneva
9-23 June	Study Group I (Transmitters)	Geneva
9-29 June	Study Group II (Receivers)	Geneva
23 June-9 July	Study Group VI (Ionospheric propagation)	Geneva
24 June-9 July	Study Group III (Fixed service systems)	Geneva
30 June-9 July	CMTT (CCIR/CCITT Joint Commission for television transmissions)	Geneva
1-10 September	Study Group XIII (Mobile services)	Geneva
	International Telegraph and Telephone Consultative Committee (CCITT):	
15-26 March	Working Party No. 1 (Signalling system No. 6) of Study Group XI	Geneva
29 March-8 April	GAS 1 (Mr. Banks' Working Party)	Geneva
5-9 April	Working Parties for small diameter coaxial pairs and 12 Mc/s systems	Geneva
4-11 May	Joint Working Party of Study Group V and Study Group VI (Protection against lightning)	Rome
9-18 June	Working Party No. 1 (Intercontinental maintenance) of Study Group IV	Geneva
21-25 June	Joint Special Study Group C (CCITT/CCIR) (Circuit noise)	Geneva
28 June-2 July	Working Party No. 2 (Use of the test chart) of Study Group XIV	Geneva
13-24 September?	Working Party No. 1 (Signalling system No. 6) of Study Group XI	Stockholm
13-17 September	Working Party No. 2 (Automatic transmission measuring equipment) of Study Group IV	Geneva
20-24 September	Working Party No. 4 (Network stability) of Study Group IV	Geneva
27-30 September	Working Party No. 3 (Maintenance programme) of Study Group IV	Geneva
25 October-3 November	Study Group XII (Telephone transmission performance)	Geneva
4-10 November	Study Group XVI (Telephone circuits)	Geneva
15-19 November	Study Group VI (Protection and specifications of cable sheaths and poles)	Geneva
22 November-3 December	Special Study Group A (Data transmission)	Brussels
12 April-18 May	**ITU Administrative Council,** 20th Session	**Geneva**
14 September-12 November	**Plenipotentiary Conference**	**Montreux (Switzerland)**

International Telecommunication Convention (Geneva, 1959)

Afghanistan has ratified the International Telecommunication Convention (Geneva, 1959).

The instrument of ratification was deposited with the General Secretariat of the Union on 19 January, 1965.

Convention on the Privileges and Immunities of the Specialized Agencies

The Government of the **Democratic Republic of the Congo** deposited with the Secretary-General of the United Nations, on 8 December, 1964, its instrument of accession to the Convention on the Privileges and Immunities of the Specialized Agencies among which is the International Telecommunication Union.

Regional Agreement for the African Broadcasting Area concerning the use of frequencies by the broadcasting service in the very high frequency and ultra high frequency bands (Geneva, May 1963)

The **United Arab Republic** has acceded to the above-mentioned Agreement.

Telephone Regulations (Geneva, 1958)

Thailand has approved the Telephone Regulations (Geneva, 1958).

International Radio Consultative Committee (CCIR)

The **Canadian Association of Broadcasters,** Ottawa, has asked to participate, as a recognized private operating agency, in the work of the CCIR.

This request has been approved by the Canadian Administration.

The " ITT Communication Systems, Inc.", Paramus (New Jersey), will belong in the future to the " Computer Sciences Corporation ". The company will be known as **Communication Systems, Inc.,** and would like to maintain its affiliation with the CCIR.

The desired affiliation has the aproval of the United States of America Administration.

International Telegraph and Telephone Consultative Committee (CCITT)

The " ITT Communication Systems, Inc.", Paramus (New Jersey), will belong in the future to the " Computer Sciences Corporation ". The company will be known as **Communication Systems, Inc.,** and would like to maintain its affiliation with the CCITT.

The desired affiliation has the approval of the United States of America Administration.

The **Marconi International Marine Company Limited,** Chelmsford, has asked to participate, as a recognized private operating agency, in the work of the CCITT.

This request has been approved by the United Kingdom Administration.

Invitations accepted to conferences or meetings external to the Union

Date	Organization	Nature of conference or meeting	Place	Representatives
1965				
23 February-20 March	International Civil Aviation Organization (ICAO)	Special North Atlantic Meeting	Montreal	Mr. J. A. Gracie (IFRB)
16-29 March	Economic Commission for Asia and the Far East (ECAFE)	21st session	Wellington	Mr. K. V. Pai (ITU expert)
20-24 April	European Broadcasting Union (EBU)	17th meeting of the Technical Committee	Lugano (Switzerland)	Mr. M. H. Roberts (IFRB)

List of recent and forthcoming publications of the International Telecommunication Union

The following letters indicate the languages in which documents are published:

F *for French* **S** *for Spanish*
E *for English* **R** *for Russian*
C *for Chinese*
Prices are in Swiss francs

Note

A comprehensive list of all the publications of the Union will be supplied free on request.

I. Publications issued since the last number of the Journal

Summary of monitoring information received by the IFRB
No. 102 (November 1964)
Trilingual edition **F, E, S.**

Tentative high frequency broadcasting schedule (J, 1965)
Period: 2 May-5 September 1965
Trilingual edition **F, E, S.**

High frequency broadcasting schedule (M, 1964)
Period: 1 March-3 May 1964
Trilingual edition **F, E, S.**

II. Forthcoming publications

Map of coast stations which are open to public correspondence or which participate in the port operations service, 9th edition, 1965

List of telegraph offices, 22nd edition, January 1966
Trilingual edition **F,E,S.**

List of fixed stations operating international circuits, 3rd edition, June 1965
Trilingual edition **F, E, S.**

Summary of monitoring information received by the IFRB
No. 103 (December 1964)
Trilingual edition **F, E, S.**

Summary of monitoring information received by the IFRB on the use by broadcasting stations of the exclusive high frequency broadcasting bands
6 Summaries per year:
4 Summaries related with the last and first weeks of any two consecutive seasonal schedules
2 Summaries related with the seventh week of any four-month seasonal schedule
Trilingual edition **F, E, S.**

High frequency broadcasting schedules
(4 publications per annum)
Trilingual edition **F, E, S.**

List of ship stations, 5th edition, December 1964
Trilingual edition **F, E, S,** possibly **R, C.**

List of broadcasting stations operating in bands below 5950 kc/s, 3rd edition, June 1965
Trilingual edition **F, E, S.**

List of broadcasting stations operating in bands between 5950 and 26 100 kc/s, 2nd edition (September 1961-August 1962)
Trilingual edition **F, E, S.**

Report of the First Session of the Extraordinary Administrative Aeronautical Radio Conference, Geneva, January-February 1964
Separate editions in **F, E, S.**

List of international telephone routes, 5th edition, 1 January 1965 (Europe, Africa, the Americas, Asia, Oceania, intercontinental channels).
Trilingual edition **F, E, S.**

Table of international telex relations, on 31 December 1964
Trilingual edition **F, E, S.**

Alphabetical list of call-signs of stations other than amateur stations, experimental stations and stations of the maritime mobile service **(List VIIB),** 2nd edition, 1965
Multilingual edition in **F, E, S, R, C.**

International frequency list, 3rd edition, 1965
Preface in separate editions **F, E, S.**
Titles and column-headings of volumes I, II, III and IV in **F, E, S, R, C.**

International Radio Consultative Committee (CCIR):

Xth Plenary Assembly, Geneva, 1963
Vol. I — Emission. Reception. Vocabulary. **Spanish** edition
Vol. II — Propagation. **Spanish** edition.
Vol. III — Mobile service. Standard frequencies and time signals. Monitoring. **Spanish** edition.
Vol. IV — Radio relay systems. Space systems. Radio astronomy. **Spanish** edition.
Vol. V — Broadcasting, Television. **Spanish** edition.
Vol. VI — List of participants. Reports to the Plenary Assembly. Resolutions of a general nature. Place of the XIth Plenary Assembly, etc. **Spanish** edition.
Vol. VII — Minutes of plenary meetings. **Spanish** edition.

Manual on high-frequency directional antennae
Separate editions in **F, E, S.**

Propagation data obtained in radio-relay systems
Trilingual edition **F, E, S.**

International Telegraph and Telephone Consultative Committee (CCITT):

Directives
Spanish edition possibly.

Codes and abbreviations for use in international telecommunication, 2nd edition
Spanish edition

Manual on the National telephone networks for the automatic service
Spanish edition

Instructions for the intercontinental telephone service
Spanish edition

IInd Plenary Assembly, New Delhi, 1960
Red Book
Vol. V. **Spanish** edition.

IIIrd Plenary Assembly, Geneva, June 1964
Red Book
Vol. V bis — Additions and amendments (Quality of telephone transmission and telephone apparatus)
Separate editions in **F, E, S.**

Blue Book
Vol. I — Minutes and reports of the IIIrd Plenary Assembly. Resolutions, Opinions, Recommendations, Questions; Study Groups and Working Parties for 1964-1968
Vol. II — Telephone and telegraph operation and tariffs
Vol. III — Line transmission
Vol. IV — Transmission maintenance of international lines, circuits and chains of circuits
Vol. VI — Telephone signalling and switching
Vol. VII — Telegraph technique
Vol. VIII — Data transmission
Vol. IX — Protection against disturbances. Protection of cable sheaths and poles
Separate editions in **F, E, S.**

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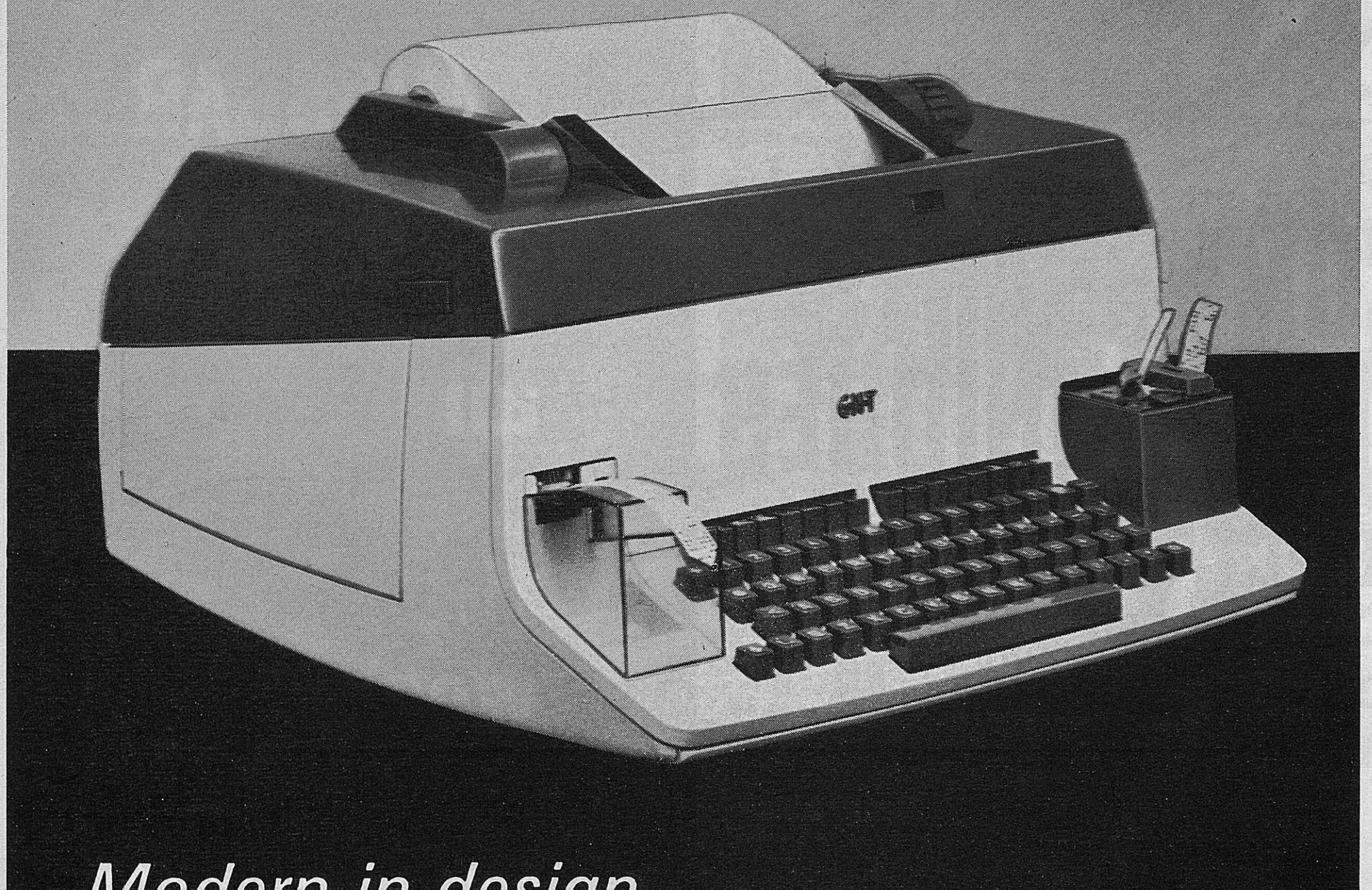

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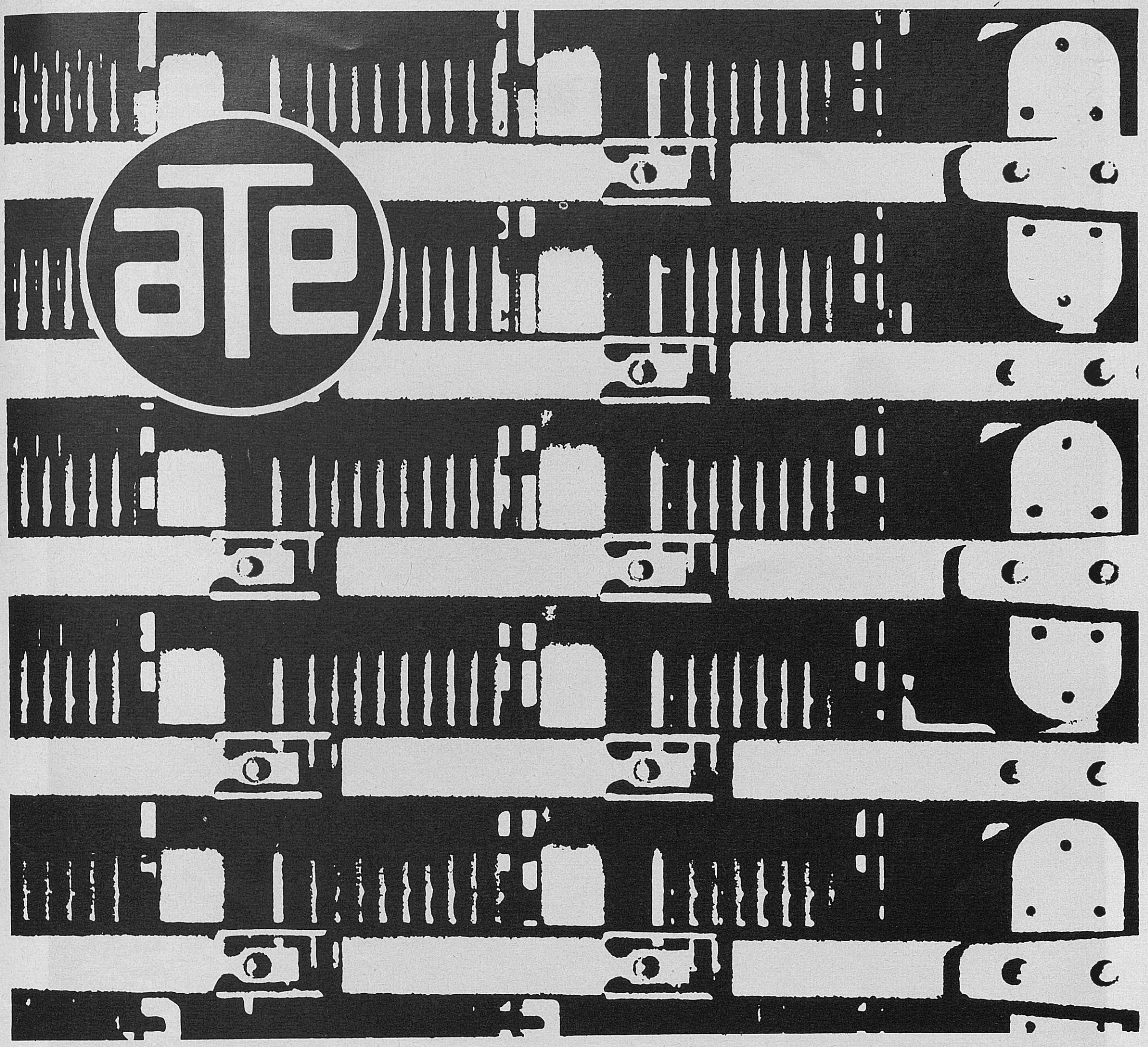

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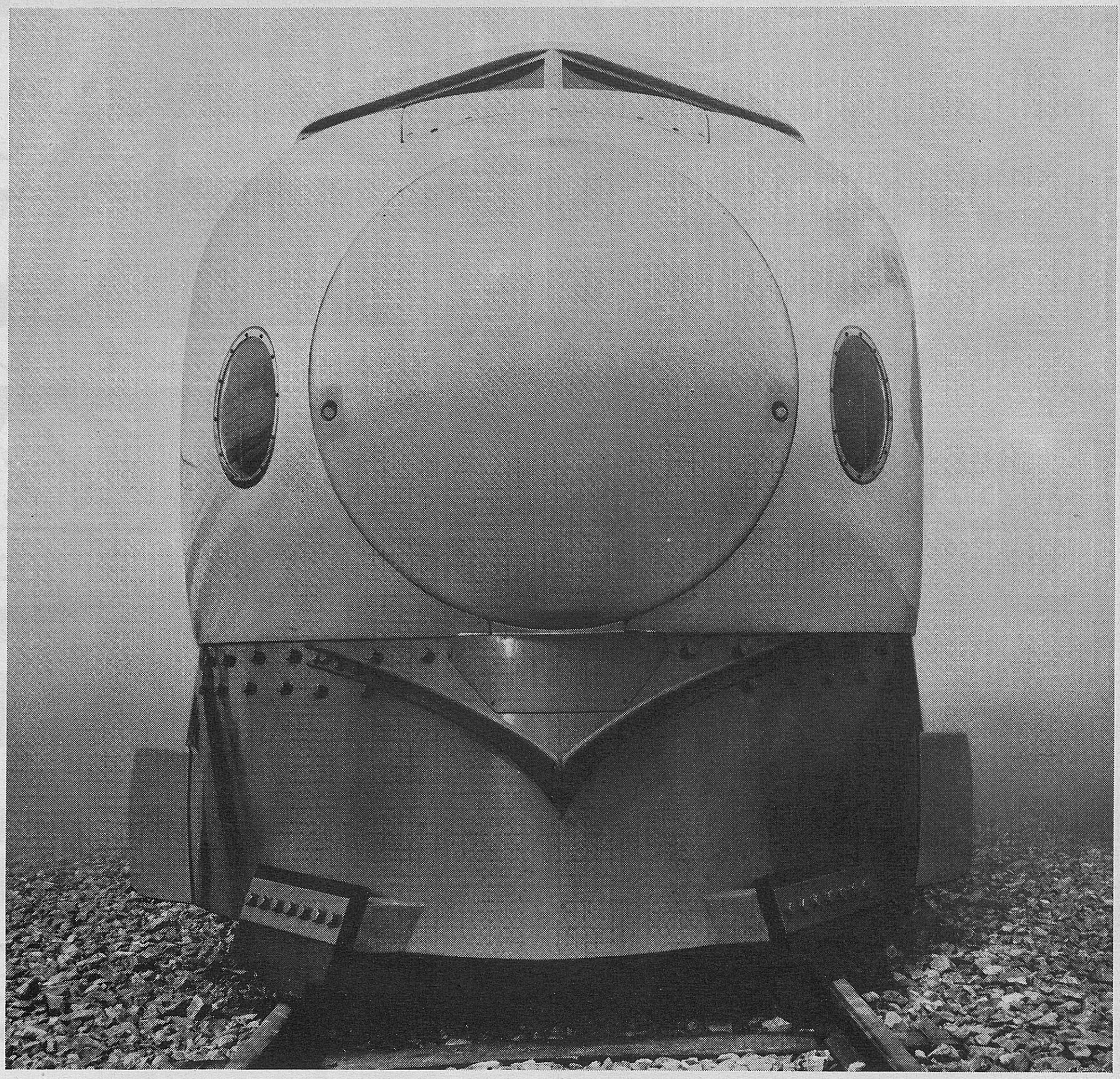

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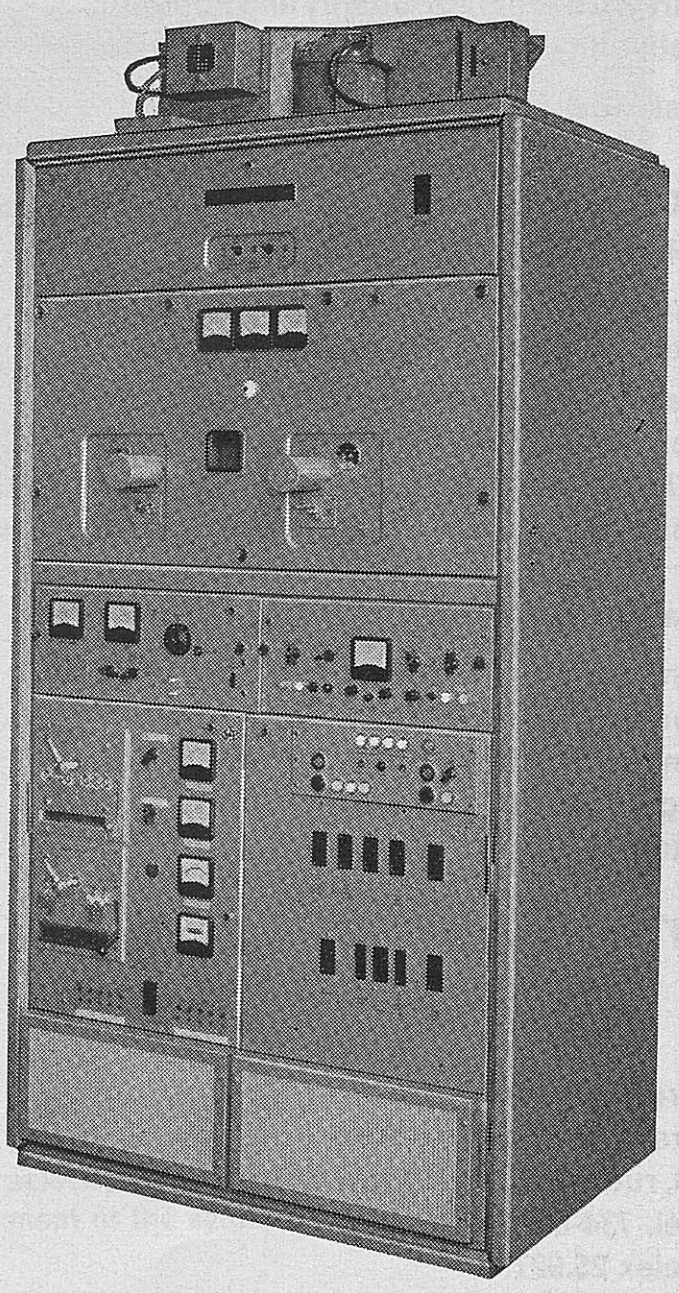

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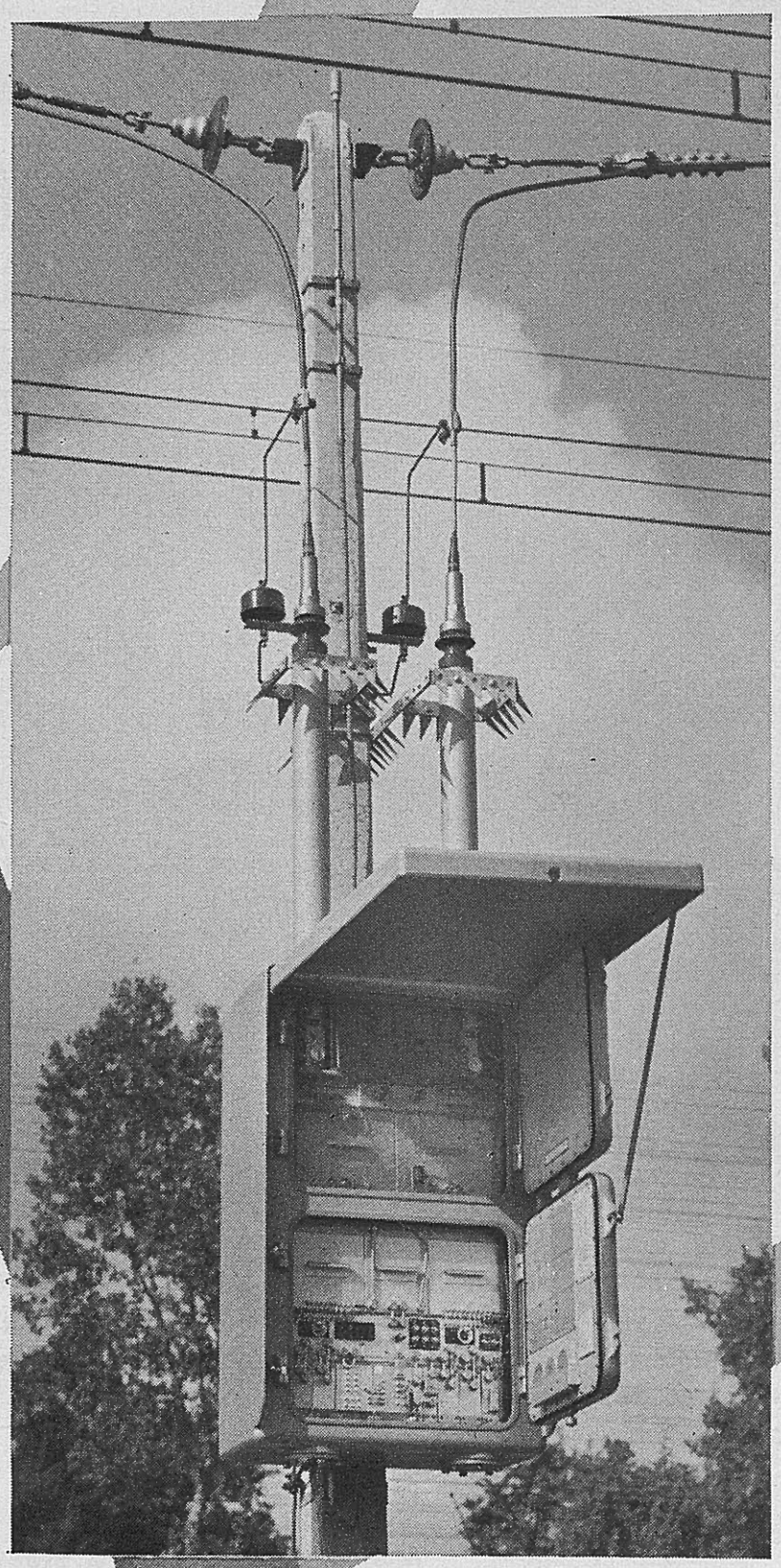

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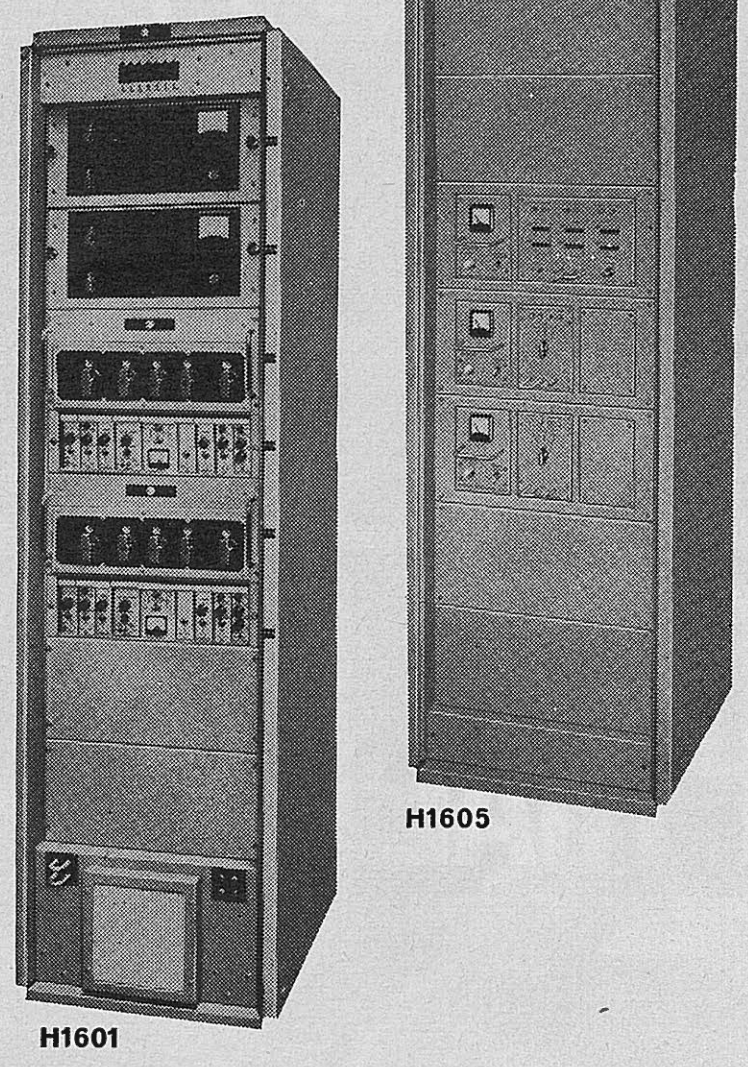

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Types of modulation: i.s.b with floating carrier, pilot carrier or fully suppressed carrier; d.s.b; c.w 400 bauds; f.s.k 200 bauds or 3500 bauds; frequency shift diplex
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H1605

1 Mc/s master frequency source
Frequency stability: $\pm$ 1 part in 10^8

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Any drive channel can generate any type of modulation. F.S.K and f.s diplex signals are generated by shifting the frequency of 2 kc/s or 4 kc/s tones—thus one transmitter can radiate simultaneously two or more telegraph channels and an s.s.b channel.

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The 1/4" PYRAL magnetic tapes are manufactured on acetate polyvinyl or polyester.
The acetate and polyester tapes should be used with a bias inferior by 15% to that of the tapes achieved on polyvinyl base.
The first ones are better adapted to equipments using an equalization compatible with ASA standards, whereas the second ones suit equipments adjusted according to the C.C.I.R. standards.

Documentation complète sur demande. Write for full details. (ea)

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FIAR

FABBRICA ITALIANA APPARECCHI RADIO

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Telefono 306.241 - 306.841 - Telex 31295

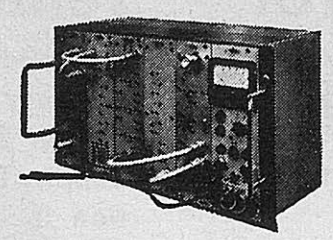
PRODUZIONE

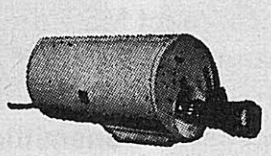
- Televisione a circuito chiuso
- Impianti di diffusione sonora
- Apparecchiatura per trasmissioni TV
- Ricetrasmettitori radio
- Radar e ausiliari
- Apparecchi elettronici
- Apparati ausiliari della navigazione
- Antenne ed accessori

Rappresentante e licenziataria per l'Italia della TELEFUNKEN AG per gli apparati radio-professionali

RIPETITORE TELECAMERA

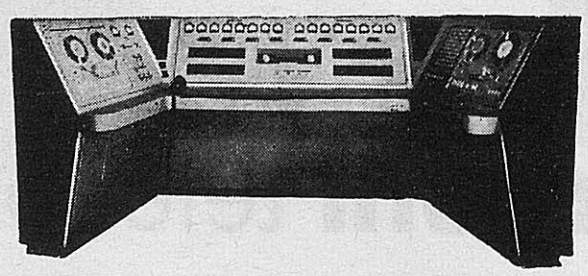
TRANSISTORIZZATO





p 817

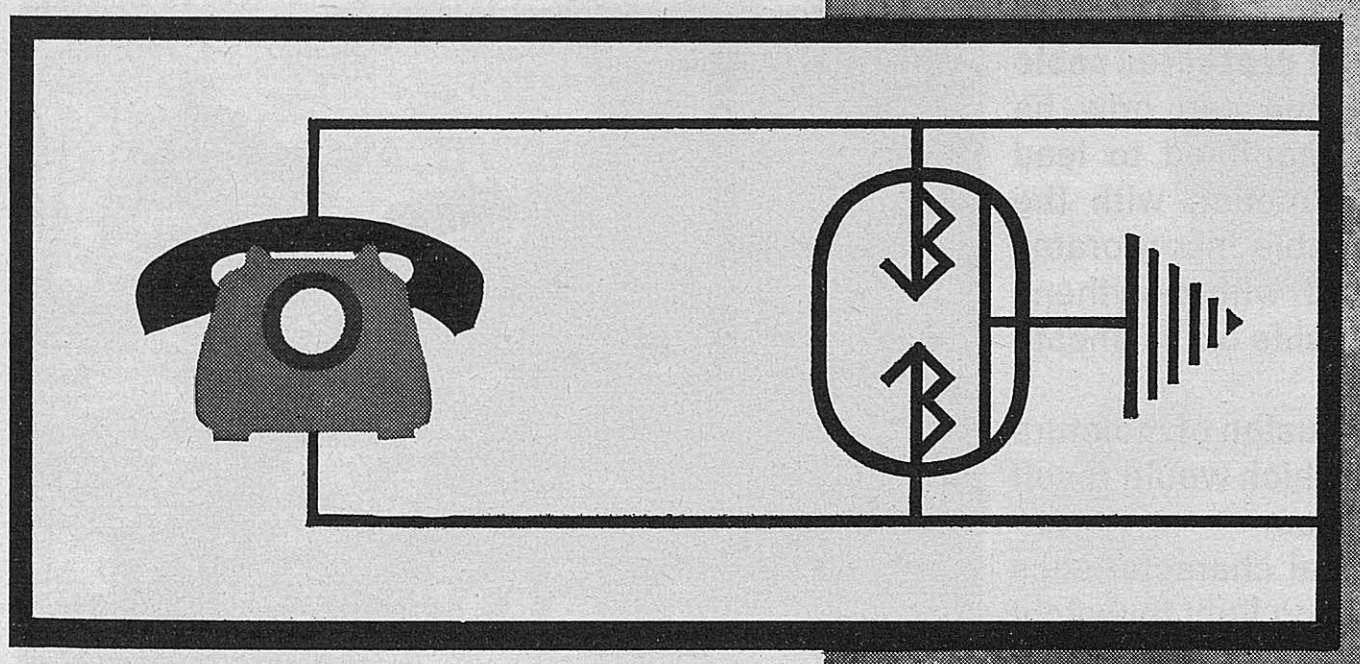
TELEVISIVO p 149 TRANSISTORIZZATA



BANCO DI REGIA PER GRANDI IMPIANTI DI DIFFUSIONE SONORA

Increased protection cuts maintenance costs

The latest A E I Protector–No. 16 provides an exceptionally high degree of protection for communication and instrument circuits.
It operates many times without attention and thus considerably reduces maintenance costs. The three-electrode construction enables it to replace two conventional protectors and, due to the tendency of both gaps to break down simultaneously, it minimises the excess voltages to which the apparatus is subjected.
The protector will withstand momentary peak currents of about 20,000 amps and many hundreds of 100 Joule discharges.
Prompt delivery can be offered, because demand from many parts of the world has proved so high that production capacity has been greatly expanded.
The protector is available in three breakdown voltage ranges:—
150—350 d.c.
300—500 d.c.
500—900 d.c.

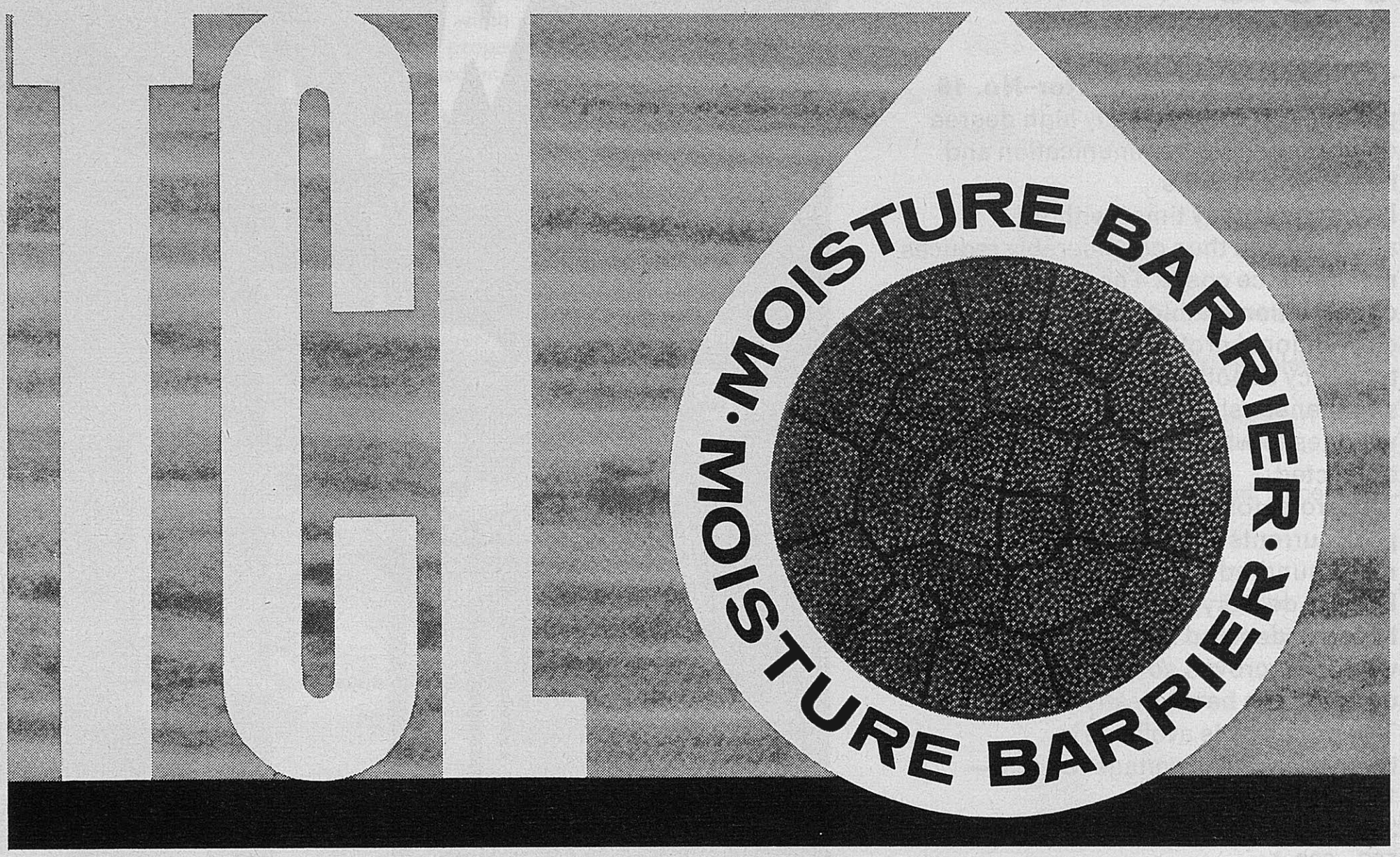


AEI COMMUNICATIONS

Associated Electrical Industries Limited
TELEPHONE APPARATUS DEPARTMENT
Telecommunications Division Woolwich London SE18

TA 9261

new paper-insulated plastic sheathed moisture barrier cable by



Lighter–for easier handling, longer lengths, fewer joints
Working life equal to lead sheathed and protected cable

Paper insulated plastic sheathed cable can now be employed under conditions hitherto confined to lead sheathed cables. Developed in conjunction with the British Post Office, this new T.C.L. cable incorporates paper insulated conductors sheathed with polythene having aluminium foil bonded to the inside of the sheath to form a moisture barrier.

This barrier effectively prevents the diffusion of moisture vapour through the polythene sheath which would result in a lowering of the insulation resistance.

This produces a cable having electrical characteristics equal to a lead sheathed cable and being light in weight has many economic advantages, plus freedom from sheath corrosion. Besides forming an electro-static screen, the aluminium foil can also be used to detect insulation failure due to any mechanical damage.

T.C.L. moisture barrier cable at Windsor Castle.

TELEPHONE CABLES LIMITED

Dagenham, England. Tel: Dominion 6611 Cables: Drycore Dagenham

THE ORGANISATION WITH 125 YEARS' EXPERIENCE

A complete telecommunications service by line and radio

The range of transmission equipment manufactured by G.E.C. enables integrated national and international networks to be built-up catering for all traffic requirements. Ease of future expansion is an inherent feature of the equipment.

Backed by more than 40 years of experience, Transmission Division can offer a complete service including surveying, system planning, engineering, manufacturing, installing and commissioning. Where necessary, customer's engineers are trained by the Company locally or at the G.E.C. Telephone Works in Coventry.

G.E.C. transmission equipment is in operation throughout the world, in climatic conditions which range from arctic to equatorial. Throughout the range of equipment, semiconductors are used wherever possible.

HIGH-CAPACITY SYSTEMS

The Company manufactures a comprehensive range of completely transistored carrier multiplex equipment up to 2700 channels, for use over coaxial cable or microwave radio routes. Six types of broadband radio equipment are available; four in the SHF 6000 Mc/s and 7000 Mc/s frequency bands and two in the UHF 2000 Mc/s band. These equipments have maximum capacities varying between 300 and 1800 speech circuits per radio channel according to type. Alternatively, monochrome or colour television signals may be transmitted.

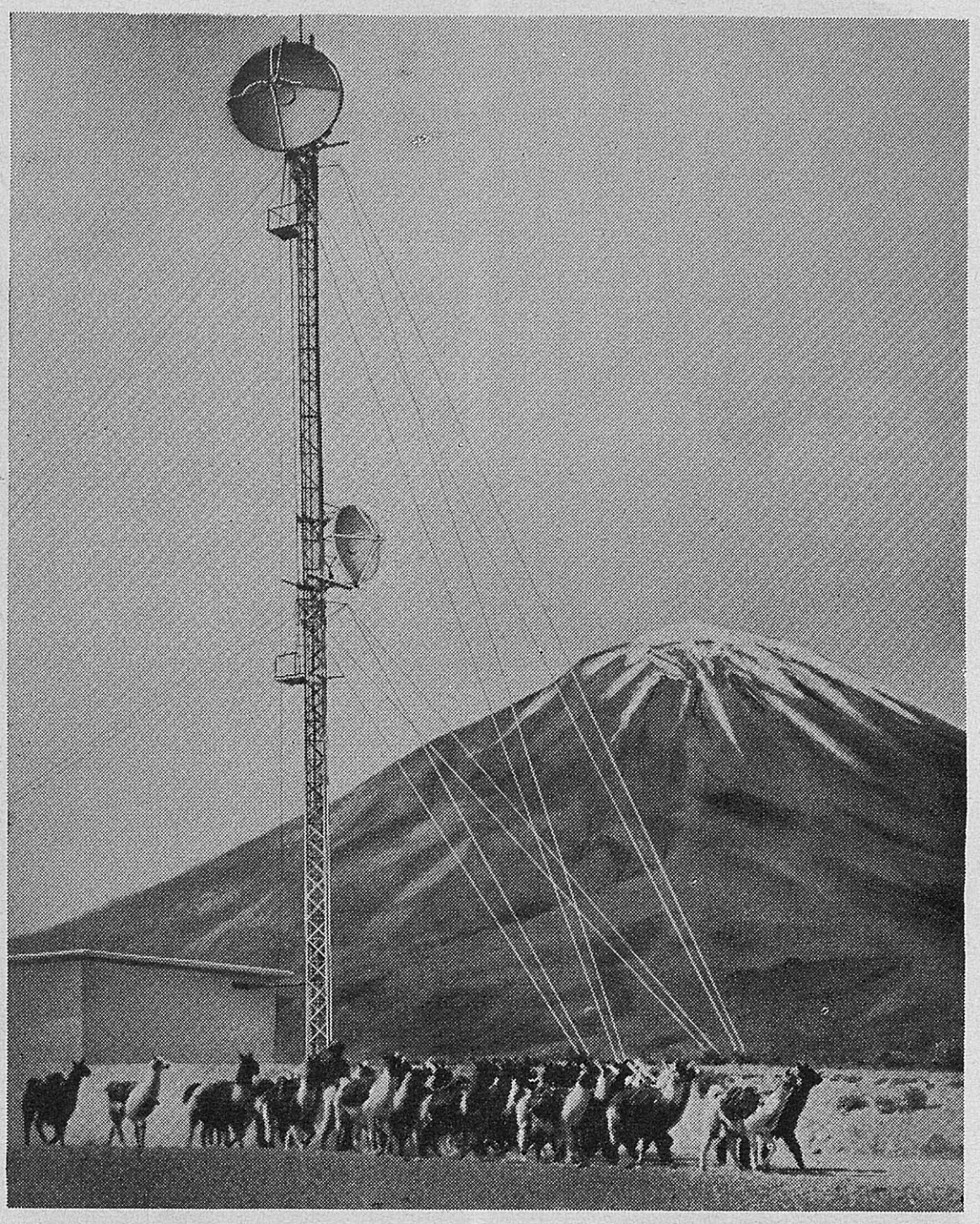
A small-bore coaxial cable system with a maximum capacity of 960 speech circuits is also available.

All these equipments conform to the recommendations of the C.C.I.T.T. and C.C.I.R.

SMALL-CAPACITY SYSTEMS

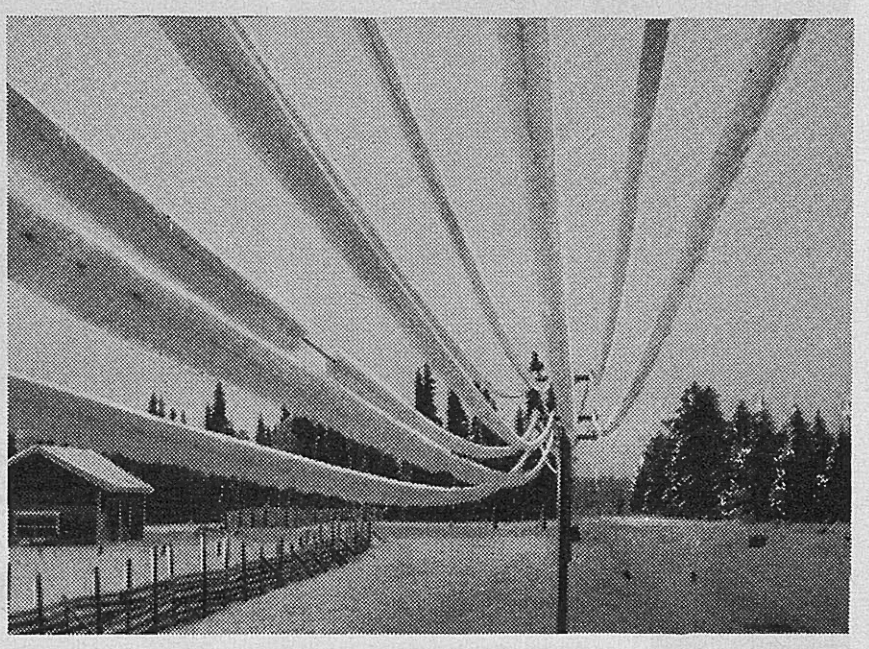
Small-capacity systems available include completely transistored 3 and 12-circuit open-wire and 12+12-circuit carrier-on-cable equipments. A transistored rural carrier system which provides up to ten stackable subscriber circuits in rural areas or up to ten junction circuits is also manufactured. This equipment can be operated over the same pole route as a 3 or 12-circuit system.

Junction radio equipments, operating in the VHF and UHF bands with capacities of 5 or 9 speech circuits, are supplied.



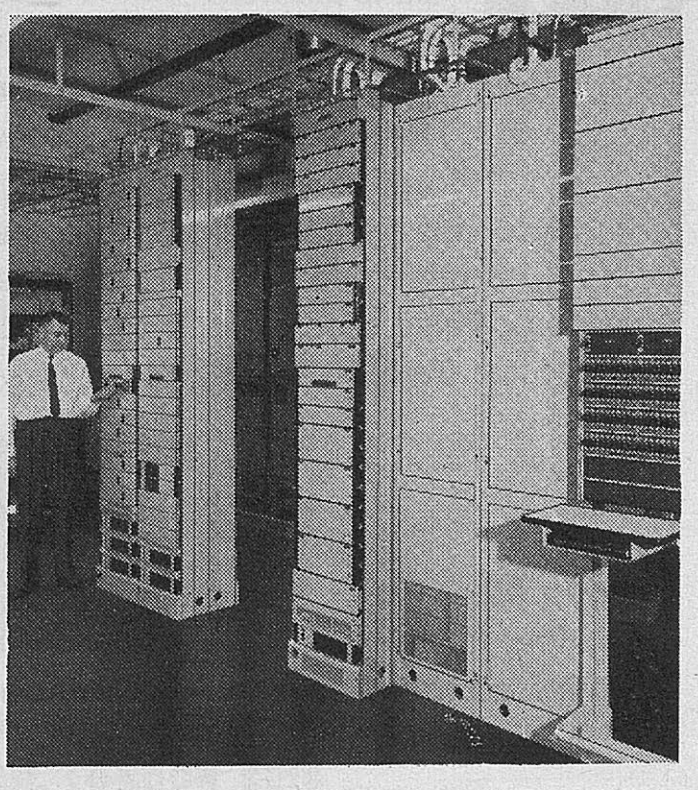
UHF Radio Repeater Station at Caima, Peru.

Right: Open-wire line route in Finland.



Bottom right: Carrier Multiplex Equipment at Toronto Terminal, Canada.

Bottom left: 6000 Mc/s Repeater Station at Maxwell's Hill in Malaya.

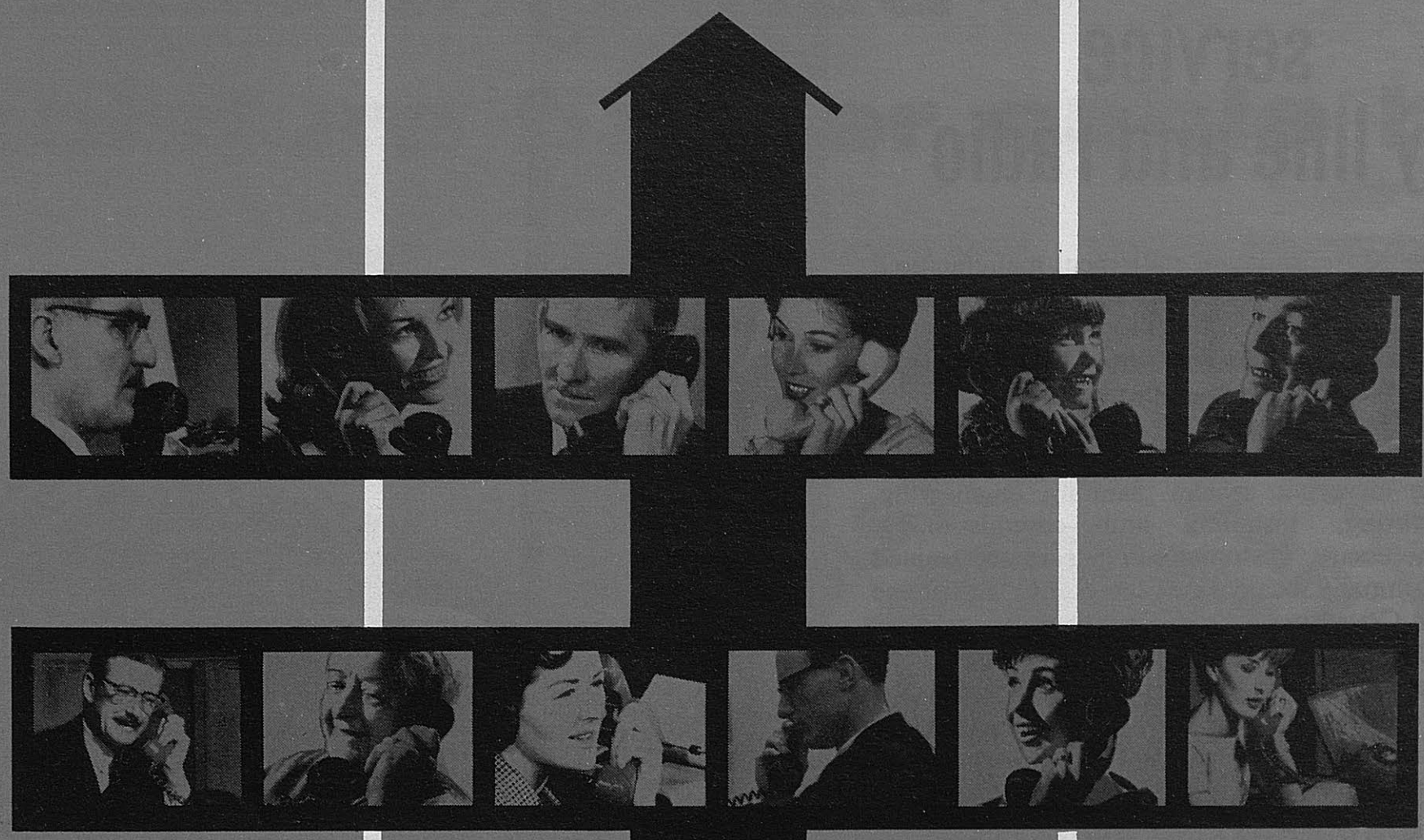


G.E.C.

everything for telecommunications

Transmission Division·G.E.C. (Telecommunications) Ltd
Telephone Works · Coventry · England

RPS



aTe

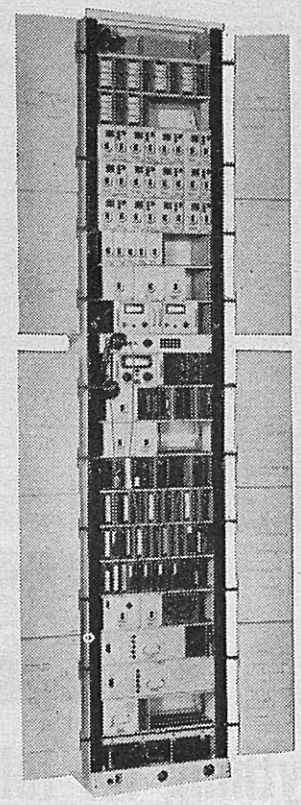
12 channels on a single pair– using the AT&E/W12H

You can operate a dozen high-quality speech circuits simultaneously on an existing open-wire pair, if you add a transistorised AT&E Type W12H Terminal at each end. The space-saving, low-power-consumption CM construction used in the W12H makes it doubly efficient, doubly reliable. For specific information about how this advanced, multi-channel carrier system can expand your channel capacity at minimum cost, please write to:
Automatic Telephone & Electric Co. Ltd., 8 Arundel St., London, W.C.2, England.
Telephone: Temple Bar 9262. *A Principal Operating Company of the Plessey Group*

Capacity:
12-speech channels—all with full signalling facilities.
Transmission: 2-wire.

Line frequencies:
36-143 kc/s.
Channel bandwidth:
300-3400 c/s.
Input power: 75 watts.

A complete W12H terminal



ATE(E)18

FROM BRITAIN'S LARGEST ELECTRICAL GROUP...

THE NEATEST, MOST PROFITABLE PACKAGE IN THE TELEPHONE BUSINESS!!!!!!!!!

The A.E.I., C.A.T.T. system has been specially developed to meet the needs of the North American Continent-wide Direct Distance Dialling Scheme. In conjunction with our A.N.I. system, which determines the calling subscriber's number and class of service for accounting purposes, it provides the necessary computer/business – machinery – legible record of long distance calls. This twin high-grade A.E.I. package takes up less space, is fully flexible, can be applied to all existing telephone systems and complies with all specified requirements of D.D.D. It can be supplied as a complete unit or two separate systems. Prices are competitive – in fact, A.N.I. costs less than any comparable equipment available today.

C.A.T.T.

CENTRALISED AUTOMATIC TOLL TICKETING

- Handles all D.D.D. routing functions and it will work with existing Register/Translator equipment where operator or toll dialling facilities already exist.
- D.C. or M.F. outpulsing to suit local conditions and to give remote operation by C.S.P. routing machine where required.
- Checking Person to Person, collect calls, etc. by routing to a manual operator with automatic sending under the operator's control if required. Alternative routing with foreign area translation. Code Conversion and up to three exit digits to accommodate local area trunking problems.
- Full Sender/Tabulator/Translator Common Control giving maximum equipment economy and security.
- Suitable for application to all types of national, regional and local Toll Switching centres.
- Employs the service proven A.E.I. High Speed Motor Uniselector for all talking and coupling functions.

C.A.T.T. equipment is currently being manufactured for the Alberta Government Telephones for the important Edmonton Class 3 Primary Centre, and Saskatchewan Government Telephones for the Swift Current Toll Centre.

A.N.I.

AUTOMATIC NUMBER IDENTIFICATION

- D.C. Working giving an inexpensive system which does not interfere with the operation of the telephone exchange, works at high speed and is immune from misoperation by outside agencies.
- Absolute reliability based on the use of proven telephone components backed by 100 years of design experience and embodying self checking and fault printout facilities.
- D.C. loop outpulsing or Multi-Frequency High Speed (MF) outpulsing to suit all destination signalling conditions, individual sets of transistor oscillators being supplied in each A.N.I. Register.
- No special power or tone supplies required.
- Complete compatibility with most types of telephone exchange equipment and all types of Automatic Machine Accounting equipment.
- Unlimited Class Marks without restriction of the basic A.N.I. facility.

A.N.I. equipment is already being supplied to Canada to the tune of half a million lines.

AEI COMMUNICATIONS

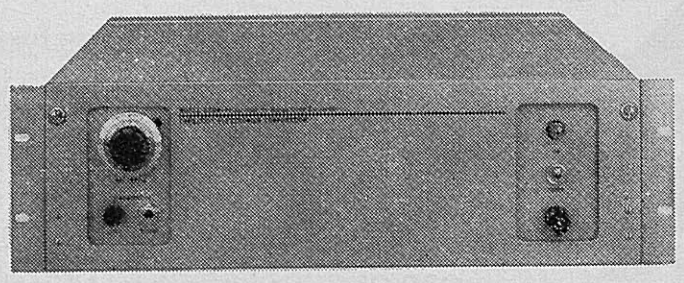
For full technical details, please contact:

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED
TELECOMMUNICATIONS DIVISION, WOOLWICH, LONDON SE18

TA914

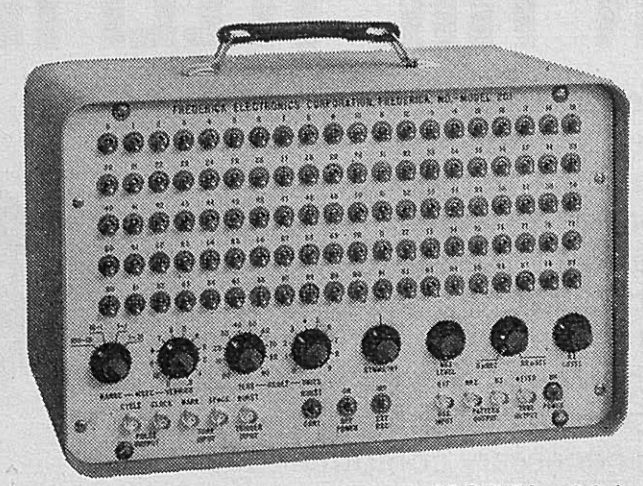
Telecommunication Equipment by FREDERICK ELECTRONICS CORPORATION

A communications electronics company experienced in the design, development and manufacture of data transmission and telegraph equipment.



MODEL 660A

Teleprinter-to-Morse Code Converter
for Simplified Morse Code Operation

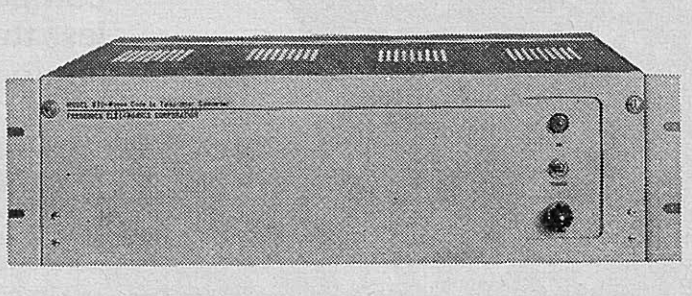


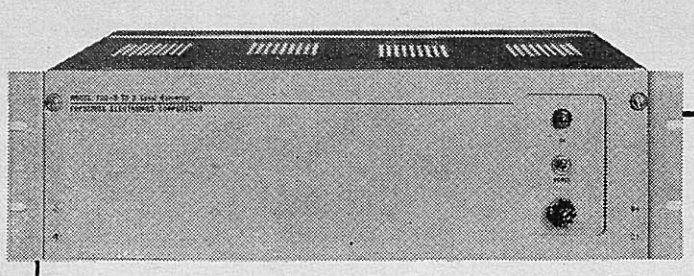
MODEL 201

Pulse Pattern Generator
simulates virtually any Digital Data Signal

Morse to Teleprinter Converter
for Simplified Morse Code Operation

MODEL 670



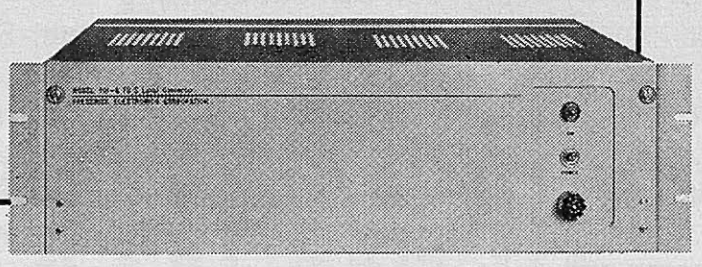


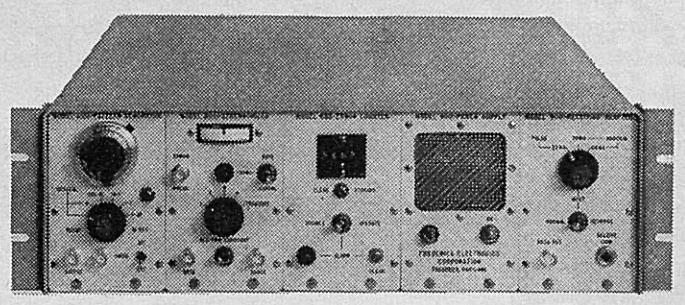
MODEL 700

5 Level to 8 Level Converter
provides interface between standard 5 level Baudot circuits and the new 8 level ASCII

8 Level to 5 Level Converter

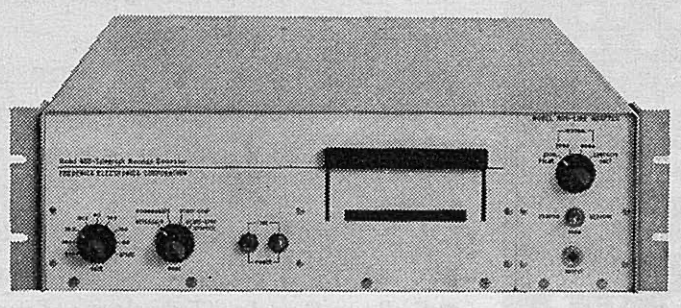
MODEL 701





MODEL 600

Data Transmission Test Set
for Wire Line, Radio and Recorded Systems

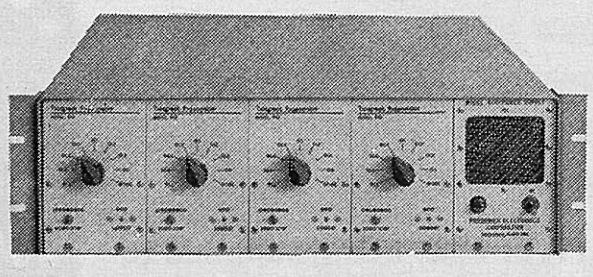


MODEL 400

Telegraph Message Generator
replaces most Tape and "Canned" Message Transmitters

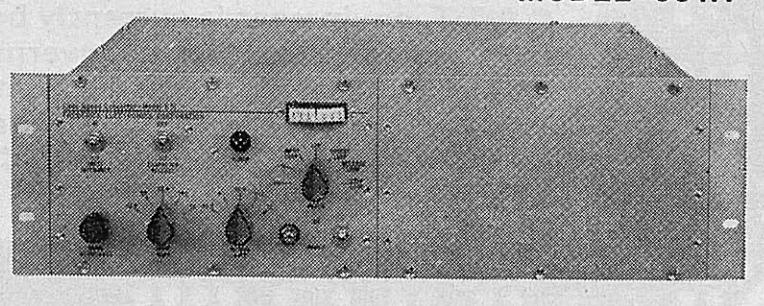
MODEL 352

Telegraph Regenerator
for restoration of distorted start-stop or synchronous telegraph signals



MODEL 651A

Code Speed Converter
provides interface between teletypewriter circuits operating at different baud rates



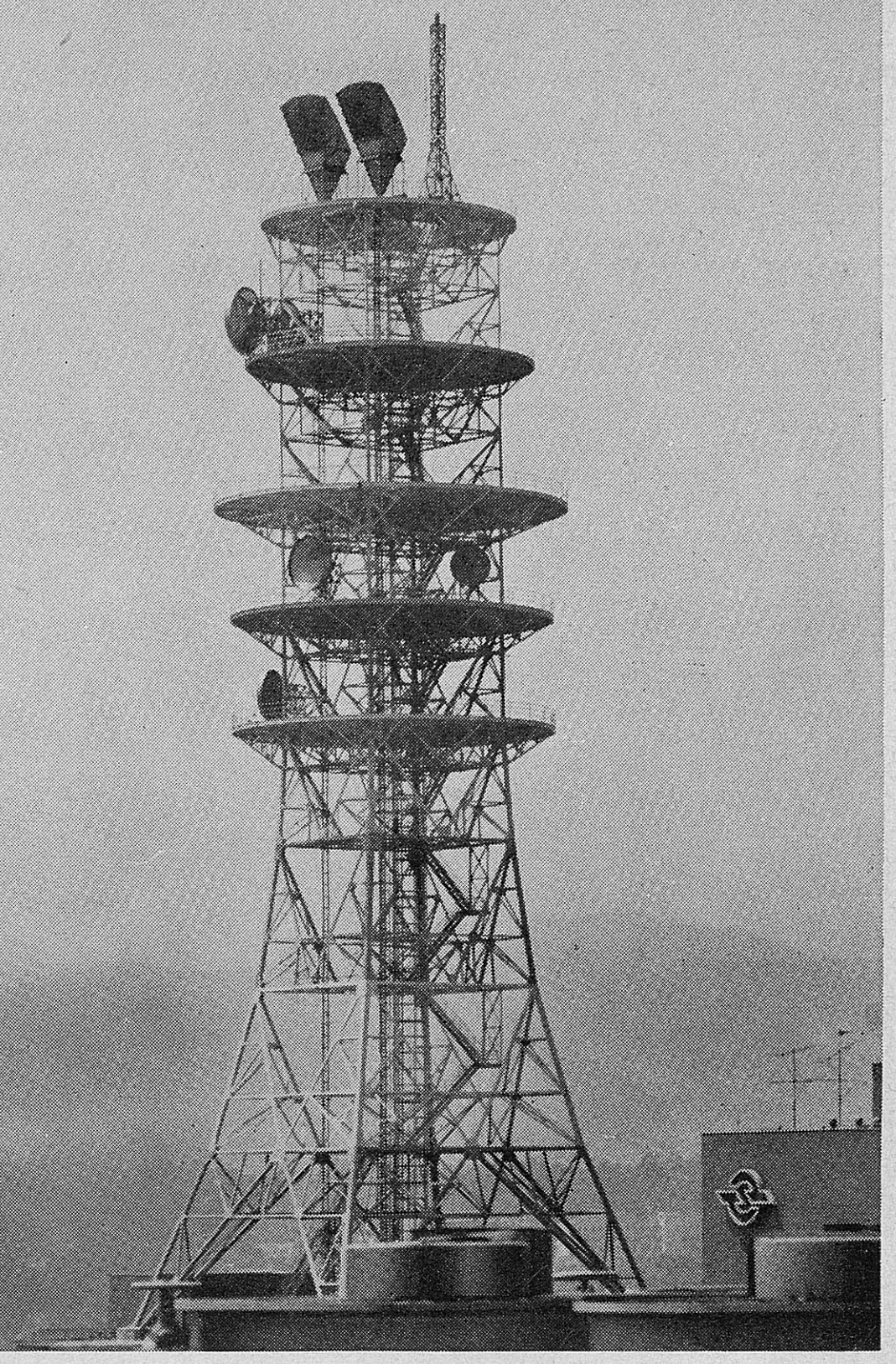
FEC

FREDERICK ELECTRONICS CORPORATION

International Division

750 Third Avenue, N.Y. 17, N.Y., U.S.A. Cable Address: ARTROCKE
Factory: Frederick, Maryland

MITSUBISHI MICROWAVE ANTENNAS FOR TELECOMMUNICATIONS



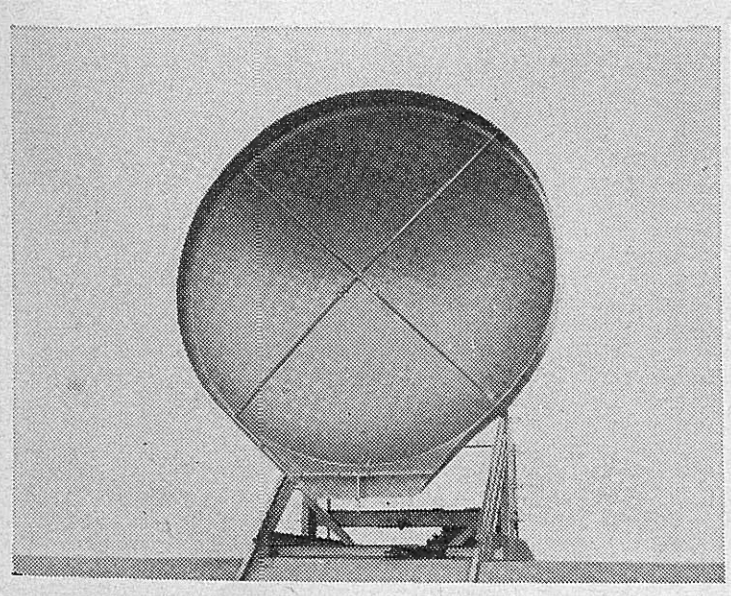
Japan today has the second largest microwave network in the world. Mitsubishi Electric, with the longest microwave antenna experience in Japan, has supplied 90% of the antennas used in the trunk lines of this extensive network. Mitsubishi antenna systems include parabolic, scatter, horn reflector and radar types, as well as a complete line of waveguide components and accessories. Frequencies from 900 Mc. to 24 KMc. are covered. The IU-62, shown above and specified at the right, is typical of the outstanding performance of Mitsubishi microwave antennas. Full technical information on any of these types of antennas is available at your request.

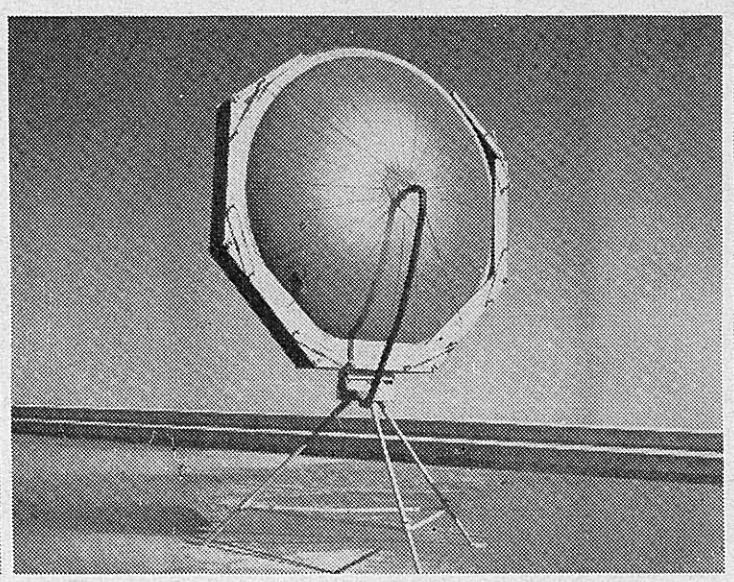
IU-62 Horn Reflector Antenna

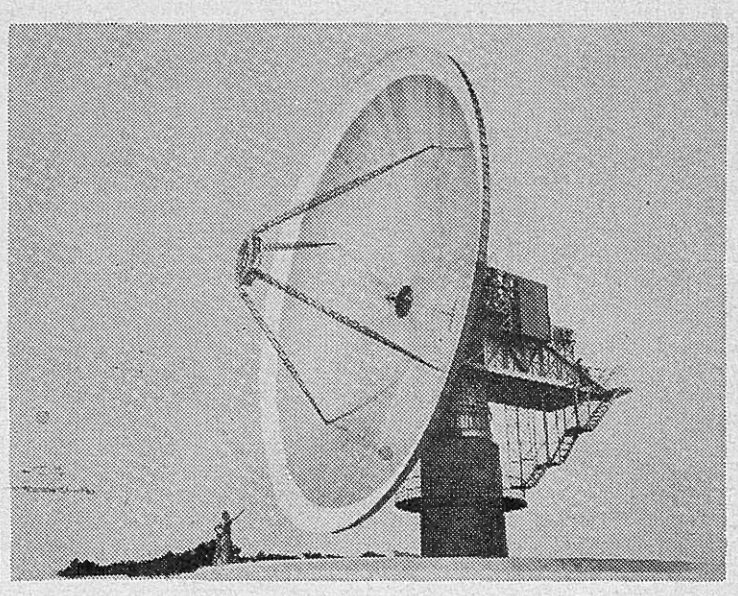
Frequency Range	3,000-12,000 MC
Aperture	9m²
Max. width	4,050mm
Max. depth	2,560mm
Max. height	7,418mm
Gain at 3,900MC	V 41.5 db
	H 41.2 db
Gain at 6,100MC	V 44.9 db
	H 45.0 db
VSWR	1.01
Front/Back (over 60 degrees)	67-70 db
Discrimination of cross polarization	V 57 db H 78 db (at 3,900MC)
	V 45 db H 37.5 db (at 6,100MC)
Guaranteed wind velocity	140 miles/hr

MITSUBISHI ELECTRIC CORPORATION

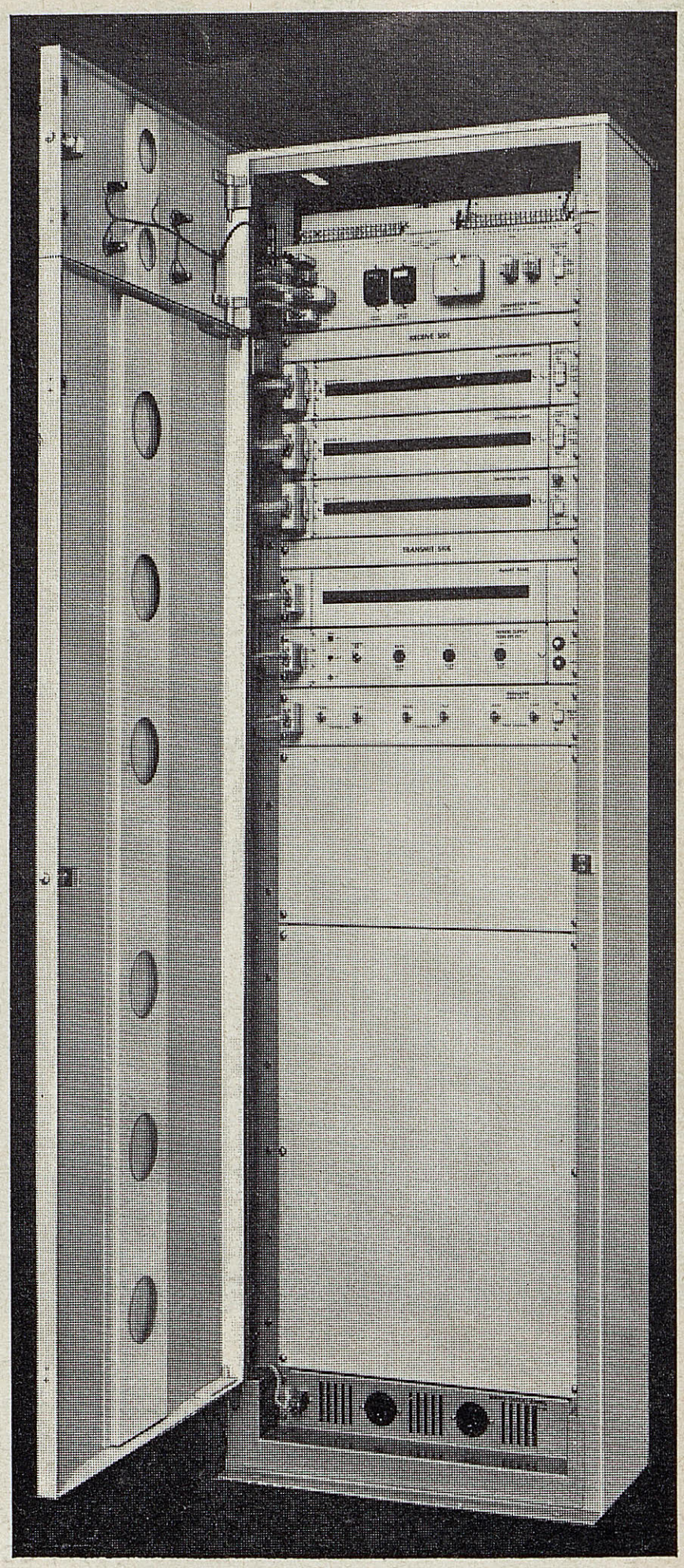
Head Office: Mitsubishi Denki Bldg., Marunouchi, Tokyo. Cable Address: MELCO TOKYO

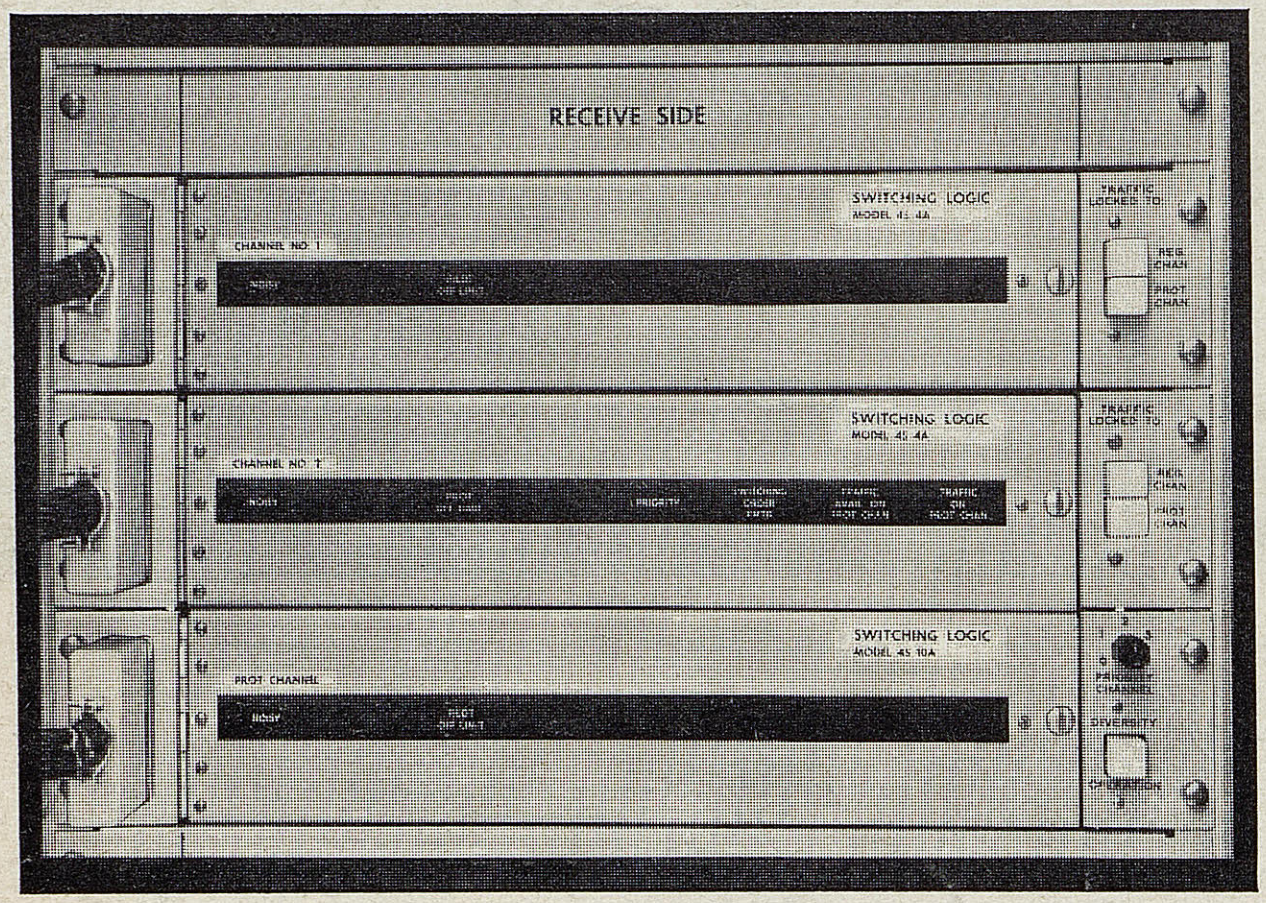






High Speed Switching with greater reliability!





Increase the efficiency of your communications system with

NERA NK 5

Automatic Protection Switching System

– provides automatic re-routing of traffic in microwave and related systems.

Extendible from 1 + 1 to 5 + 1 systems ■ Solid state switching ■ Diversity switching virtually interruption-free ■ Automatic and/or manual operation ■ Easy change of priority.

NERA

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